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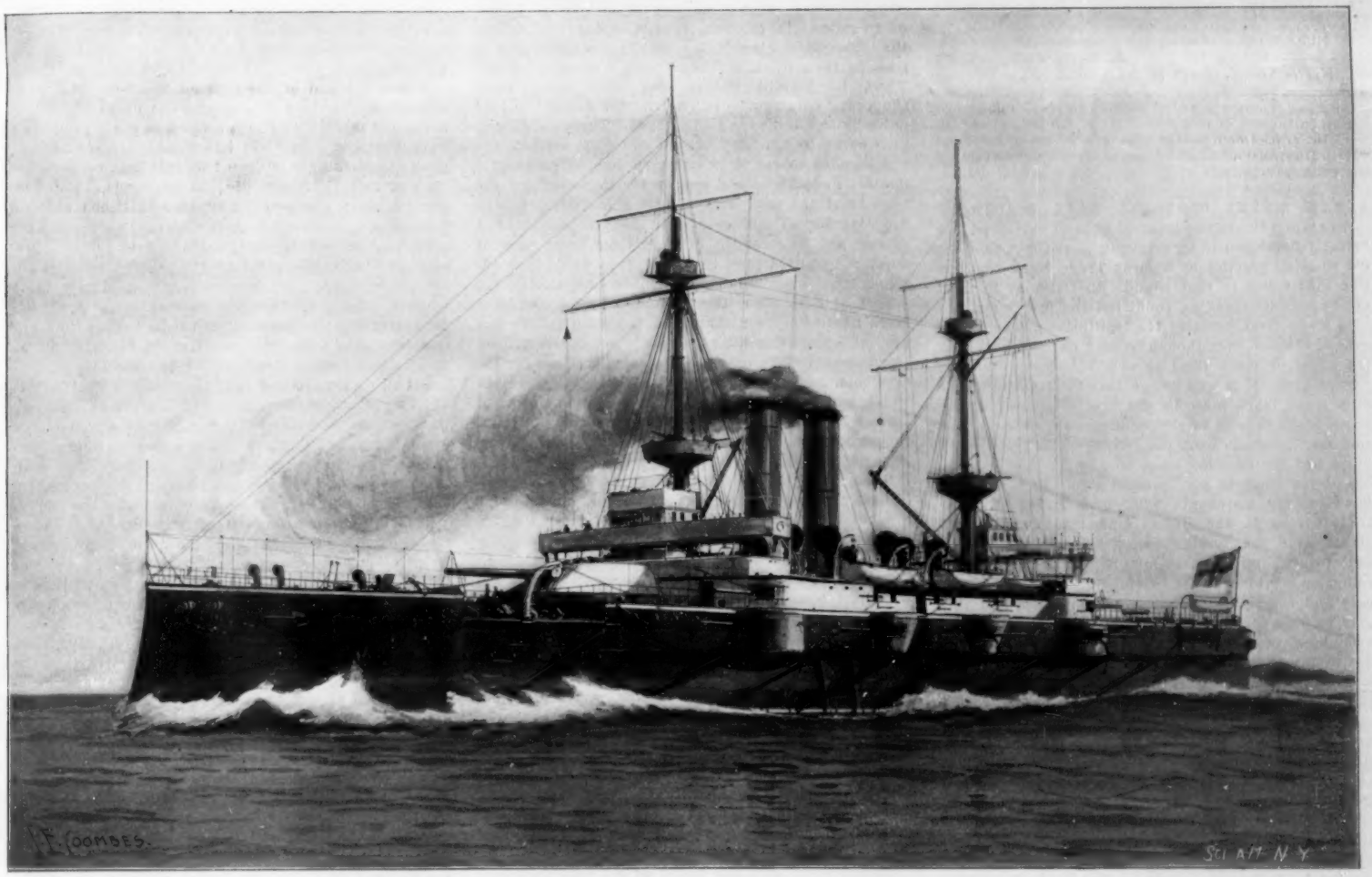
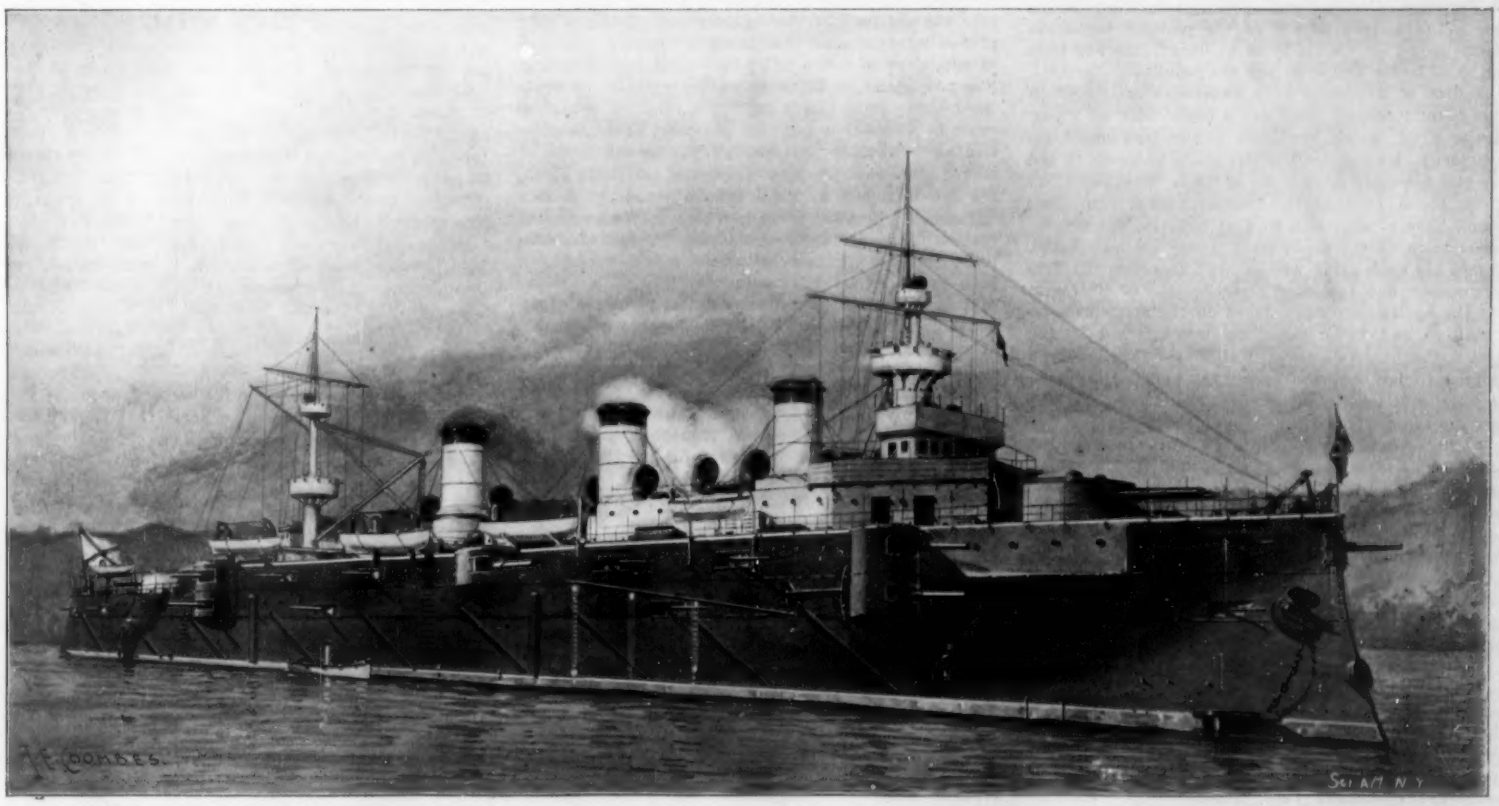


NEW BATTLESHIP "DUNCAN" OF THE BRITISH NAVY. CLASS OF SIX SHIPS.—[See page 39.]

Displacement, 14,000 tons. **Speed,** 19 knots. **Bunker Capacity,** 2,000 tons. **Armor:** Belt, 7 inches; gun positions, 11 to 6 inches; decks, protective 3 inches, gun deck, 1 inch. **Armament:** Four 12-inch; twelve 6-inch rapid-fire; twelve 3-inch rapid-fire; six 3-pounders. **Torpedo Tubes,** 4. **Complement,** 750.



NEW RUSSIAN BATTLESHIP "PERESVIET." ALSO "OSLABYA" AND "POBIEDA."—[See page 39.]

Displacement, 12,674 tons. **Speed,** 18 knots. **Bunker Capacity,** 2,056 tons. **Armor:** Belt, 9¼ inches; gun positions, 9 inches and 5 inches; deck, 2¾ inches. **Armament:** Four long-caliber 10-inch; eleven 6-inch rapid-fire; twenty 3-inch rapid-fire; ten 6-pounders; seventeen 1-pounders; two field guns. **Torpedo Tubes,** 4 **Complement,** 722.

Scientific American.

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NEW YORK, SATURDAY, JULY 20, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

A NEW SCHEME OF TRADE MARK BLACKMAIL.

An extraordinary and unusual form of enterprise has recently developed in Cuba owing to the fact that the old Spanish practice as regards Trade Mark registration still exists in that island. In Cuba, as in most of the Spanish-speaking countries, the first registrant of a trade mark becomes the legitimate owner in the eyes of the law, even though he may have appropriated the name or mark from some other source. In the United States it is well known that the rightful owner of a trade mark must be the first originator of the mark, while in most foreign countries the ownership of said mark depends upon the formal act of registration alone and the question as to who is the first originator of the mark is not inquired into. It is possible, however, for merchants who have registered their trade marks in the United States to extend their rights over the foreign possessions of the United States, including Cuba, by simply registering in those countries certified copies of the United States certificate and complying with other formalities, and this may be done for a trifling fee. It is astonishing, however, how very lax our manufacturers and merchants are in regard to this matter and what penalties they have to pay for their ignorance or neglect. It appears that there is in Cuba a small gang of clever "gentlemen" who have determined to profit by the carelessness of American merchants and who make it a practice to register such marks as they think are likely to be extensively used in trade in that country. Several instances have recently come to our notice in which an ounce of prevention would have saved a world of trouble and annoyance. The American merchant has no redress, and when he places his goods on the Cuban market he is politely informed that he is infringing Mr. John Doe's trade mark and is notified to discontinue. He is naturally half amused and nonplussed at Mr. Doe's temerity, but when the Cuban Certificate of Registration is produced showing a facsimile of his mark, the serious nature of his position begins to dawn upon him. What is to be done? He has been guilty of laches and must pay the penalty.

A firm of wholesale drug merchants registered in this country several years ago a trade mark on a particular drug, which has since attained an enormous popularity. No registration was made, however, in the colonial possessions, and one of these "gentlemen" in Cuba, above referred to, foreseeing that this drug would have a large sale in that country, applied for registration of the trade mark under his own name. Before his application was granted, however, the firm in question had applied for registration of its mark, but the application was refused on the ground of anticipation and the registration was granted to the first applicant. As a sequel to this, the firm has been obliged to buy out the successful applicant, paying something between eight hundred and a thousand dollars for the certificate thus fraudulently obtained.

We have repeatedly pointed out in these columns the necessity of attending to these formal details which are so important in protecting trade rights in most foreign countries, and the foreign commerce of the United States is becoming so extensive that these matters should not be neglected or forgotten. We are happy to say that many of the great commercial houses are fully awake to the importance of protecting their interests in this matter, and the danger of neglect is being happily more and more understood.

THE STRUGGLE OF THE CUP CHAMPIONS.

The races which have already been sailed between the "Columbia," the "Constitution" and the "Independence" have given a very clear line on the respective merits of the yachts. As far as the two Herreshoff boats are concerned (the "Independence," unfortunately, being at the present writing not a candidate for cup-defending honors), the New York Yacht Club is confronted by a dilemma, which must forcibly remind it of the earlier contests for the "America cup," when the club was accustomed to bring a whole fleet of its yachts to the starting line, and select that yacht which was best suited to the particular kind of weather which was encountered on the morning of the race. For it is a fact that the races thus far sailed between the old champion, "Columbia," and the new boat, "Constitution," have shown that in light winds of from four to five knots strength the "Constitution" is unquestionably superior, while in winds of from seven or eight knots strength and upward the "Columbia" is the faster vessel. In the first race between the two boats, sailed in a good topsail breeze, the "Columbia" beat the "Constitution" by 2 minutes and 10 seconds over a windward and leeward course of 30 miles. In the next race "Constitution" turned the tables by beating "Columbia" by 9 minutes and 49 seconds in a five-knot breeze over a similar course. Then, in a still lighter and very fluky wind, she beat "Columbia" over a triangular course of 30 miles by 29 minutes and 35 seconds. Three days later, in a seven to ten knot breeze, and over a windward and leeward course of 30 miles, "Columbia" wins by 4 minutes and 35 seconds; and on the following day she wins her third race from "Constitution," this time in a strong breeze and over a triangular course, by 1 minute and 40 seconds. Judging from these races it must be admitted that, in the average winds that are encountered over the Sandy Hook course during the month of September, the "Columbia" seems to be a more likely defender than the "Constitution" in her present form. It must be remembered, however, that there are yet two months of tuning-up in store for the new boat, and it is quite possible that the experience which will be gained in the many races and informal trials which she will pass through may bring her up to the point at which she can defeat "Columbia" in any kind of weather.

In the first two races of the Newport series the conditions of wind and sea were the worst possible for a yacht with the flat floor and long overhangs which characterize the "Independence"; and she practically did not figure in the finish of these two trials. In the third race, however, the sea was smoother and the wind had more heart in it, with the result that she turned the outer mark ahead of the "Constitution" and was only beaten 2 minutes and 15 seconds by that yacht over the whole course. In the fourth race she had the misfortune to carry away her topmast, and thus lost the opportunity to show what she could accomplish under the conditions which are supposed to be most favorable for a yacht of her kind. The performance of the "Independence" in the last races shows that she may yet prove herself to be a match for the Herreshoff boats in a strong and steady wind, and on any occasion when the three yachts may meet during the coming season there will be the liveliest kind of interest in the result.

Concurrently with the defeat of the new American Cup defender by the old champion comes the information that, in the course of the sailing trials which are now taking place between the two "Shamrocks," the new boat is beginning to show a decided superiority over the old one, her best performance being a gain of five minutes over "Shamrock I." during a thrash to windward of seven miles in a good topsail breeze. She now seems to be unmistakably superior to windward and a trifle faster down the wind. The significance of these trials depends, of course, upon the question as to whether "Shamrock I." is sailing faster or slower than when she met "Columbia" off Sandy Hook. We are informed by those who are connected with "Shamrock" that her mast has been stepped two feet further forward than it was during the last Cup contests, and that changes have been made in her keel, both modifications having in view the improvement of her windward qualities. As the result of these changes, and the admittedly excellent work which "Shamrock I." has been doing this year, she is estimated to be from 5 to 10 minutes faster over a 30-mile course than she was two years ago. As this is about the time by which she was beaten by "Columbia," it would look as though the new "Shamrock" were going to prove a very active competitor for the Cup. Until "Constitution" has shown her undoubted superiority to "Columbia" under any possible conditions of weather, it is probable that not even the New York Yacht Club itself will look upon the America Cup as being, in the current phraseology of the day, "safe." It is probable, however, that as the season advances there will be a steady improvement in the new yacht, and that when the final Cup trials are sailed she will prove to be a winner by margins which will depend merely upon the weather conditions under which the course is sailed.

A NAVAL PROBLEM.

The rapid growth of our navy has naturally created many new problems, which the Department has solved with more or less success; but probably the most pressing question for solution in the immediate future is that of obtaining a sufficient number of commissioned officers to command the new ships building. The need for more officers of high standing was never so apparent, and no relief can come from Congress until next winter. Thirty-five vessels of the torpedo-boat and torpedo-boat destroyer types will be ready to be placed in commission this summer, and there are practically no officers available to command them. Secretary Long has the power to make use of officers of the navy on the retired list, but very few of these are serviceable for active duties, and little relief can be expected from that quarter. The attempt to put young naval cadets in command of costly and delicate torpedo-boats might produce serious results. Yet to lay these new boats aside until Congress finds the time and pleasure to provide adequate officers for them means vexatious interference with the navy's contemplated plan of establishing a coast service of torpedo-boat stations.

Before the end of the summer the navy will have a numerous torpedo flotilla, and the board of officers appointed to decide upon a scheme of coast protection with boats of this class has practically determined upon establishing a series of torpedo-boat stations extending from Portland, Me., to Pensacola, Fla. The three main stations will first be established at New London, Conn., Port Royal, S. C., and Pensacola, Fla., with sub-stations between these points. These sub-stations would be selected for the purpose of affording the torpedo-boats good harbors from which they could operate. But until Congress makes definite provision for increasing the commissioned personnel of the navy commensurate with its expansion in ships, it will be impossible to carry these plans into action.

Even the summer course of study at the War College at Newport and at the torpedo stations will be seriously handicapped this season by the lack of officers. The War College and summer course of instruction opened in June, and the need of instructing more officers in the handling of torpedoes and in electricity is urgently felt. This summer at the torpedo stations the officers will be given, moreover, a thorough course in the principles of wireless telegraphy. The rapid improvement in wireless telegraphy, and its adoption by several of the European countries on their naval ships, makes it advisable that our officers should become thoroughly familiar with the system. The summer experiments with torpedoes and torpedo-craft have always been among the most interesting and instructive that the navy has undertaken, and the coming summer maneuvers would prove of special importance because of the larger flotilla ready for service, provided sufficient commissioned officers could be mustered into the service to command the new vessels.

The construction of all types of war ships now in the course of building has progressed so far that the need of more officers will steadily increase during the next year. The sixteen torpedo-boat destroyers are all more than 50 per cent completed, and the majority are nearly ready for their final trial, while eleven of the fourteen torpedo-boats are practically ready to be placed in commission. The seven submarine torpedo boats are also progressing. Of the battleships building, the "Illinois" is 92 per cent completed, the "Maine" 50 per cent, the "Ohio" 42 per cent, and the "Missouri" 32 per cent. The new protected cruisers are also being rapidly completed, with the "Denver" about 45 per cent, the "Chattanooga" 29 per cent, the "Des Moines" 28 per cent, the "Galveston" 22 per cent, and the "Tacoma" 18 per cent completed. Most of the new monitors are more than half finished. The "Nevada" is 86 per cent completed, the "Wyoming" 73 per cent, the "Florida" 65 per cent, and the "Arkansas" 54 per cent. The armored cruisers "Pennsylvania," "West Virginia," "California," "Colorado," "Maryland," and "South Dakota," with a speed of twenty-two knots, have not yet been begun. Neither have the new battleships, the "Virginia," "Nebraska," "Georgia," "New Jersey," and "Rhode Island," nor the recently authorized protected cruisers "St. Louis," "Milwaukee," and "Charleston." Nevertheless, there is a sufficient fleet of new ships soon to be commissioned to make the demand upon the Department for more officers so great that relief must come from some quarter before long. This problem handicaps the Navy Department to-day quite seriously, and even threatens the efficiency of the Naval Academy. The superintendent of this institution has complained of the lack of sufficient officers for duty there to supervise the drills, technical instruction, and general discipline of the cadets, and the Navy Department has recognized the justness of the complaint; but it is unable to afford much relief. Thus it is that Congress must at its reassembling in the fall make provision for more officers if it expects to reap the full rewards of its recent movement to extend the power and usefulness of the United States navy. While crews for new vessels may soon be recruited from practically raw material, competent officers cannot be manufactured in a few months, but must be educated and trained through a series of years.

Likewise the need of more well-trained engineers and officers in the engine-room is pressing hard for solution. The present situation in this respect is so

critical that the ultimate results on the navy may prove disastrous if some relief is not soon afforded. The old talk of regenerating the old Engineer Corps distinct from the line is now revived. This would mean the re-establishment of a corps of officers who would have no other duties than those of the engine-room. Examinations are now being held, in the Philippine Islands and at all the principal naval stations, of enlisted machinists for the rank of warrant machinists, and fifty of the two hundred applicants will be immediately appointed. In this competitive examination some good men will be brought forward, and it is believed in some quarters that these fifty appointees may become the nucleus of the new Engineer Corps.

DEFECTIVE ASSIGNMENTS OF PATENTS AND ROYALTIES.

In the transfer of property from one holder to another, certain forms of law must be observed for the protection of both parties. In the case of real estate or any merchandise whatever, conveyances may be properly drawn by attorneys familiar with the usual forms, but if a transfer of patent rights is to be made to an incorporated company, involving the allotment of shares, rights to make and vend upon royalty, the proceedings must accord with the laws of the State in which the company has been incorporated, and a thorough knowledge of corporation law is indispensable to the attorneys; otherwise, when the company attempts to transact the business for which it was organized, it will find itself unable to do so legally. Example: in some States shares cannot be assigned in payment for services rendered or for merchandise, but this has been done; consequently there has been an illegal issue of stock, and if litigation ensues at any time in the transactions of the company it may prove a bar to recovery. If an inventor finds that his company has not been properly organized, all proceedings are irregular until the work of organization has been done over, causing great delay and extra expense.

A case of this kind recently occurred in a nearby State. John Doe, the inventor of a staple article which is in great demand, and has involved a large investment of captital, had manufactured the goods upon a small scale, but finding his business growing beyond his facilities, applied to a firm of brokers to increase his capital. To do this they required him to have the company incorporated, having, of course, previously investigated the proposition as an investment. The company was incorporated, the work having been done by a lawyer who asserted that he was familiar with the procedure, and had started several companies upon the road to success. A directory was elected and regular meetings held to take over the property of John Doe, after which it devolved upon the brokers to arrange for the issue of full-paid, non-assessable shares at certain prices, and both parties awaited results. John Doe, as the owner of the patents, was to receive a certain sum for them from the sales of stock made by the brokers, the company itself advancing no cash in the first instance to secure the property to itself, and the rights of John Doe in the patents were not to be transferred until he had received the money for them. This was thought to be an equitable arrangement for both parties, but in the light of better legal advice it was seen that there had been no transaction whatever. The company, although ostensibly ready to do business, had nothing to do it with, for the company did not own anything, having actually bought nothing, and certainly could not issue, transfer or sell what it did not own; the shares allotted to be sold by the brokers or guaranteed by them, were not merchandise or lawful tender, because no one owned them. All the proceedings, therefore, were null and void, and the work had to be done over upon proper methods. Fortunately for John Doe no irregular proceedings affecting the status of the company had been taken, but delay was caused by the incompetency of the attorney, himself a resident of the State where the company was incorporated.

In the granting of licenses to make and vend, it is necessary for inventors to be very careful in selecting attorneys to draw up the papers; in no case should so-called "mutual agreements" be entered into, as between man and man, relying solely upon the assumed good faith and intention "to do what is right," as it is often termed, by both parties; the covenants should be clearly and definitely set forth. Papers or agreements which are drawn up in apparently legal phrases are sometimes wholly contradictory and adverse to both parties. One such "agreement" was drawn by parties of the first part in which a certain commission was to be paid them for the performance of certain work; but who was to pay the commission, when and where it was to be paid, was not stated. An example of the difficulties persons are liable to meet with from defective licenses is shown in the experience of Richard Roe; he had invented a certain device which was a great improvement upon a similar one then on the market and made by an old established house. The inventor went to these people, who, after examining his device, said it was better than theirs, and they would like to make it on royalty. Papers were drawn up in which they agreed to pay a certain small bonus, and thereafter a minimum amount yearly, after the manufacture had begun. The bonus was paid and the inventor at the end of a year applied to the licensees for the minimum yearly amount, having heard nothing whatever from the parties in the interim. When he asked for an accounting for the past year, no one seemed to know anything about the matter, but persistent inquiry revealed the fact that the matter had not yet been acted upon; or, in other words, the firm had simply locked the proposition up in their safe, and had no intention of ever putting the article on the market. It would have spoiled the sale of the goods they had made for years, and required a new outfit to get it up, so it was simply shelved. If the inventor had had a proper agreement, he could have instituted suit, at least, but he had put himself out of court by an agreement that gave him no recourse.

As a rule inventors are not business men; also, as a rule, they are prone to think that any paper or writing stating certain facts in legal verbiage is ample protection against trespass, but they are seriously mistaken, and cannot be too careful in parting with their rights.

INTRODUCING AMERICAN METHODS IN ENGLAND.

The immense workshop that the British branch of the Westinghouse Engineering and Manufacturing Company are having erected at Manchester is rapidly approaching completion. When in working order it will be a busy hive of British industry, giving employment to some 6,000 people. Americans will control the business for the first few months, and will then be succeeded by English engineers who at present are being initiated into American business methods at Pittsburg. The works cover 40 acres of ground and are divided into seven departments. The machine shop covers eight acres. From the north end of this shop to the south end of the power house there is a single stretch of roof 1,135 feet in length by 427 feet in width. The steel and iron foundries each cover nearly six acres; while the brass and malleable iron foundries each cover approximately four acres. There is also a fine six-story block of offices with a frontage of 250 feet. The building contains 15,000 tons of steelwork, which has cost $90 a ton, and 9,000,000 feet of timber. The electricity will at first be generated by steam power, but this will be subsequently supplanted by gas engines. Al through the grounds culverts are laid for the cables for the transmission of power throughout the various departments. The buildings alone are costing $4,500,000, and the plant to be installed will represent another $2,000,000. The location of the factory is ideal. It stands on the bank of the Manchester Ship Canal, so that vessels can proceed up to the very doors of the factory, which will result in great economy in handling the goods, while the Bridgewater Canal, which also runs alongside, will enable coal to be purchased and delivered at the factory very cheaply; and it is also in close connection with the principal railroads of the country. When completed it will be one of the largest engineering factories in Great Britain.

MANUFACTURE OF CELLULOID BEADS.

In these articles German celluloid manufacturers, we read in the Gummi-Zeitung, are unable to compete with the makers in Gablonz, who would underquote them even if the former sold at cost price, and a few details which explain this are given. There is one firm in Gablonz employing about 30 hands, and the beads are not pressed, but each one is singly turned in the foot lathe. Ordinary living rooms serve as workshops, which are lighted by electricity. It must not be presumed that this is the result of progress; it is only a matter of convenience, as Gablonz, in electric lighting, is ahead of small towns in Germany. One room contains 20 to 25 lathes, surrounded by round celluloid rods. Another room holds 6 to 8 American quick-drilling machines, also worked by foot, and attended by 6 to 10 female hands. The rods are cut up with a circular saw, which is fixed on the lathe, to the size required, and a man can cut about 3,000 per hour. They are then drilled at the rate of two to six gross per hour, according to length. After this they are turned on the lathe, each bead being separately placed tightly on a pin. The turning tool is a sharp chisel, which leaves the surface of the bead quite smooth. The polishing is done by simply holding the beads in the fumes rising from a vessel containing boiling spirit. The wages paid are very low, turners earning $2.50 to $3.75, drillers $1.75 to $2.00, and girls $1.00 to $1.25 per week.

The Cathedral of Notre Dame at Paris, which has up to the present time been only lighted by candles, is about to be lighted by electricity.

SCIENCE NOTES.

The population of Paris has increased 6.98 per cent in the last five years. At the present time the total population is 2,714,068.

The Society of German Engineers in Berlin has undertaken the preparation of an international technical dictionary to be published in English, French and German. Its aim is to secure exhaustive completeness in technical words and expressions, exactness in translation, and uniformity in usage.

A curious phenomenon was observed at the village of Le Ghazil, in the French Alps, recently. One day toward evening the inhabitants were disturbed by a loud rumbling in the vicinity of Mont Farand, which increased in intensity. Looking toward the scene of the disturbance, the villagers were further startled by seeing bright flashes of fire. At first the unusual spectacle was attributed to volcanic agencies, and a party of civil engineers set out to examine the cause of the phenomenon. They discovered that the intense dry heat had caused the chalk rocks on the summit of the mountain to crack and to break away in all directions. These rocks had descended the mountain like an avalanche, and being thickly veined with silex, in descending they had struck one another with terrific force, scattering brilliant showers of sparks in all directions, with such rapidity that they resembled one single sheet of flame.

From the known latitude of a station it is possible to calculate the number of hours that the sun is above the horizon during a year. The observations at the various stations of the United States Weather Bureau give the actual number of sun-lit hours. A comparison of the two numbers gives the percentage of sun-lit hours at the station. From the last report of the bureau (just published) the following data are selected: Albany, N. Y., 55 per cent of sun-lit hours; Atlanta, Ga., 53 per cent; Atlantic City, N. J., 58 per cent; Baltimore, Md., 66 per cent; Boston, Mass., 52 per cent; Buffalo, N. Y., 54 per cent; Charleston, S. C., 55 per cent; Chicago, Ill., 53 per cent; Cincinnati, Ohio, 61 per cent; Cleveland, Ohio, 44 per cent; Denver, Colo., 71 per cent; Detroit, Mich., 50 per cent; Galveston, Tex., 61 per cent; Indianapolis, Ind., 49 per cent; Jacksonville, Fla., 67 per cent; Key West, Fla., 71 per cent; Los Angeles, Cal., 76 per cent; Minneapolis, Minn., 52 per cent; New Orleans, La., 49 per cent; New York, N. Y., 52 per cent; Phœnix, Ariz., 84 per cent; Philadelphia, Pa., 58 per cent; Rochester, N. Y., 41 per cent; St. Louis, Mo., 62 per cent; San Diego, Cal., 73 per cent; San Francisco, Cal., 71 per cent; Santa Fe, N. M., 75 per cent; Washington, D. C., 58 per cent.

Another attempt to ascertain the difference in the longitude between London and Paris is shortly to be made by the Greenwich and Paris observers, respectively. This will make the fourth occasion upon which these two observatories have endeavored to settle this point, but their results have always differed. At the beginning of the last century the difference in longitude was estimated by primitive methods to amount to 9 minutes 21½ seconds. When the electric telegraph came into use a determination by this means proved the calculation to be one second in excess. As time progressed various circumstances proved that even this estimation was fallacious, and in 1888 a determined attempt was made by two French astronomers at the Paris Observatory and two astronomers at the Greenwich Observatory, respectively, to ascertain the actual difference. Notwithstanding their working in conjunction, no final data was attained, for, whereas the French geodists calculated the difference to be 9 minutes 21 seconds and some few hundredths of a second, the Greenwich observation was a fifth of a second less. In 1892 another attempt was made on precisely similar lines, and again the English calculation was about one-fifth of a second less than the French result. It is anticipated that the progress of geodesy within the past nine years will enable the results of the two observations to coincide this time. It is imperative that their calculations should be the same, since nations often divide their territories, when no natural boundaries are possible, by longitude and latitude. For instance, the boundary line between South Australia and New South Wales is nominally by longitude 141 degrees east of Greenwich. Telegraphic calculations, however, prove this delimitation to be erroneous by several hundred feet, a result probably due to uncertainties in the determination of the longitude. Such inaccuracies, trifling though they may appear from an evanescent point of view, are of vital importance in discussions over the boundaries between different countries, and may possibly lead to serious results. For example, the exact delimitation of the boundary line between Canada and this country in Alaska, which is at present under discussion, depends upon the astronomical observations. It will thus be seen that if the English and French observers can succeed in their measurements, or ascertain the sources of error, they will have accomplished a valuable service.

THE "PHOTOGRAPHOPHONE."

BY ERNST RUHMER.

The SCIENTIFIC AMERICAN has from time to time presented to its readers different methods of recording and reproducing both musical sounds and human speech. Of these methods, perhaps the most generally known is that employed by Mr. Edison, in which a stylus attached to a diaphragm engraves upon a rapidly revolving wax cylinder the sound impulses thrown against the diaphragm. Still another system has been devised by the Danish engineer Valdemar Poulsen, who records sounds magnetically by passing a steel ribbon between electromagnets energized with an intensity depending upon the strength of the current which has been telephonically set up in the circuit. In a third, and perhaps a more sensitive method than either of the two mentioned, photography is employed as the recording means.

Under favorable conditions the variations in the intensity of oscillation of a "speaking" arc light* are so appreciable that it is possible to record them upon a moving sensitive film. Upon this possibility the construction of my "photographophone" depends.

The photographophone, as shown in Fig. 1, consists primarily of a light-tight wooden casing in which photographic-film reels are mounted, the film as it is unwound from one reel being received by the other, as in the cinematograph and similar chronophotographic machines. The reel is driven by a small electric motor through the medium of a belt and pulley. Traveling at a uniform rate varying from 2 to 3 meters per second, the film passes the focus of a lens in front of which the source of light, which may be a speaking arc and which is caused to undulate in accordance with the sound waves, is placed at a suitable distance. The film after having been subjected to the action of the undulating light is developed in the ordinary way and fixed. If the record be very long, special developing apparatus is necessary, resembling that employed in the development of cinematograph pictures.

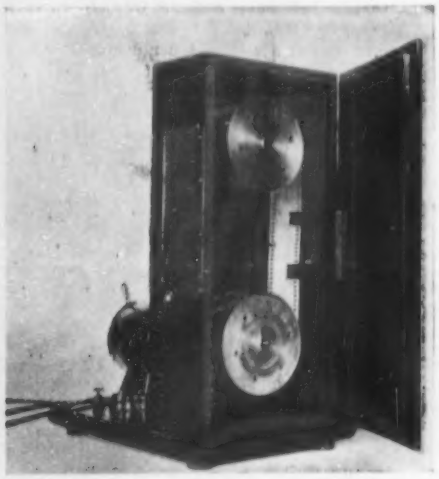


Fig. 1.—THE FILM-CASING OPEN.

The variations of light may be distinctly seen on the film. Fig. 4 shows a film which has been acted upon by the light, and then developed and fixed. In reproducing the recorded sound, an ordinary stereopticon is used in place of the original undulating source of light, the film traveling with the velocity equal to that with which the record is made. Behind the film an exceedingly sensitive selenium cell is removably mounted and connected with two telephone receivers in the circuit of a small dry battery (Fig. 3). The variable transparency of the film will cause the selenium cell to be illuminated with a light which flickers in accordance with the undulations of the recording arc. It is a well-known phenomenon that selenium conducts electricity with an intensity that varies as the light by which it is illuminated. The ever-varying light thrown upon the sensitive cell of the "photographophone" causes the current in the circuit to vary therewith, these variations of current being transformed at the telephone receivers into acoustic waves, corresponding with the sound undulations originally photographed upon the film.

By this method sounds are reproduced with astonishing distinctness. The loudness can be varied by increasing the candle power of the light employed in the stereopticon. Indeed, it is possible so to magnify the sound that a record can be reproduced with a clearness equal to that of telephone transmission. It is immaterial whether a positive be made from the film or whether the original negative be used. Apart from the extreme sensitiveness of this photographic method of recording sound, the invention is of considerable practical utility in so far as any number of positive copies can be made from the original negative. The film may be so long that the speech or song to be recorded may be almost interminable. Moreover, the films are so compact that even a very long record can be stored in an exceedingly small space.

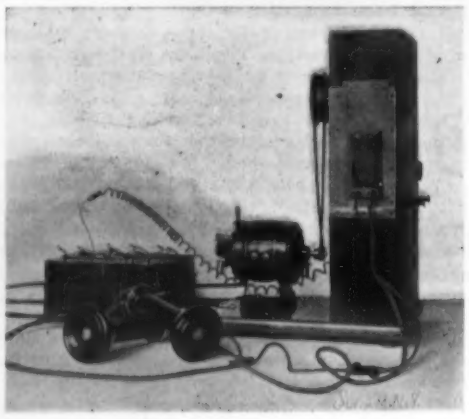


Fig. 2.—THE RECEIVER.

By using an undulating incandescent lamp in place of the speaking arc light in an improved instrument which I have constructed, I succeeded recently in attaining very good results with a film speed of 20 centimeters per second. It is my intention to employ the photographophone in connection with the cinematograph and to ascertain whether it be possible to record the movements of bodies and of sounds (such as music) upon the same film. By means of the many auxiliary apparatus which have been devised in late years for the purpose of magnifying sound, it is to be hoped that the photographic sound-record may be successfully reproduced in a large auditorium.

Berlin, April, 1901.

* SCIENTIFIC AMERICAN for June 8, 1901, page 358.

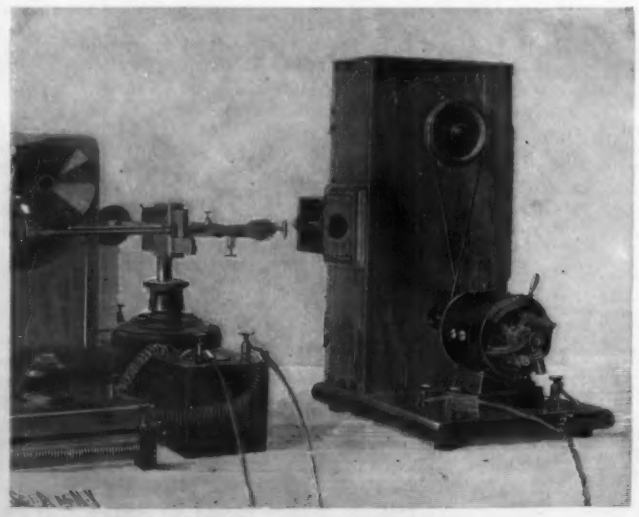


Fig. 3.—THE "PHOTOGRAPHOPHONE."

A New Method of Preparing the Hydrates of the Peroxide of Sodium and Their Properties.

M. George F. Jaubert has lately made a series of experiments with the peroxide of sodium, and finds that the hydrates of this body may be easily prepared and may be used to produce hydroxyl in different degrees of concentration; this method will no doubt be of value in different chemical operations. In an account given to the Academie des Sciences, M. Jaubert describes his experiments as follows: It is well known that the peroxide of sodium, under the action of a small quantity of water, decomposes violently with disengagement of oxygen and leaves a residue of caustic soda. This reaction is accompanied with considerable heat, and the temperature may rise above the boiling point. The following equation shows that 18 parts of water suffice to decompose 78 parts of the peroxide:

$$Na_2O_2 + H_2O = 2NaOH + O.$$

The experimenter has found that quite another reaction takes place if the peroxide is simply exposed to the action of dry air, free from carbon dioxide. In this case the quantity of water absorbed by the peroxide may greatly exceed the theoretical amount necessary for its decomposition. While 25 parts of water poured drop by drop upon 100 parts of peroxide seem to bring about an almost total decomposition, it is found that by using water vapor at the ordinary temperature the same quantity of peroxide may be made to absorb up to 200 or 225 parts of water, and this without decomposition—that is, without giving off oxygen. The experiment was carried out by placing the peroxide in a closed vessel provided with a pressure gage; the chamber contained also a vessel of water, whose vapor was constantly absorbed by the peroxide. At the end of 24 hours the pressure had not changed, but the weight of the peroxide had increased from 100 to 136; it had been transformed into a pure white and friable mass, resembling snow. It was then left for a number of days and its increase in weight per day was as follows: 100 (original), 136, 163, 223, 256, 275; at the end of 5 days more it weighed as much as 325. As the hydration may be stopped at any time, it is possible to obtain by this process, and in large quantities, the hydrates already known, $Na_2O_2 + 2H_2O$ and $Na_2O_2 + 8H_2O$, as well as a series of intermediate and unknown hydrates. M. Jaubert has studied especially the hydrate $Na_2O_2 + 8H_2O$, which he has prepared in great quantities. It appears as a snowy white mass, in contrast to the yellow color of the peroxide. It dissolves easily in water without giving off oxygen, but is less soluble in ice-cold water, and in this way may be precipitated. It is thus obtained in pearly scales resembling boric acid, and analysis gives the above formula. The hydrate of the peroxide of sodium dissolves in water with a great lowering of temperature; in concentrated acids it dissolves without appreciable change of temperature and gives solutions of hydroxyl of remarkable stability. This property makes it of great value in the preparation of hydroxyl. The hydrate is quite stable when cold, and has been kept for more than six months without appreciable change, but at 30 deg. to 40 deg. C. it partially decomposes and gives off oxygen; at 80 deg. to 100 deg. its decomposition is total. This body, which may be easily prepared in the laboratory, permits of obtaining solutions of hydroxyl chemically pure and in all degrees of concentration up to 85 per cent.

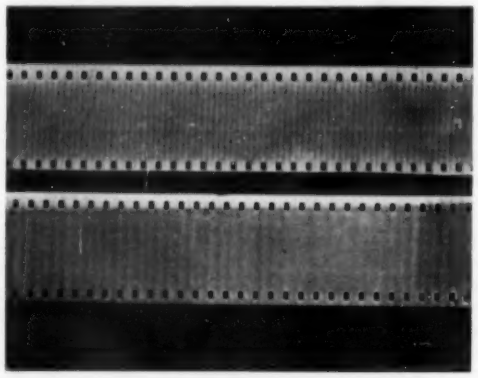


Fig. 4.—A PHOTOGRAPHIC SOUND-RECORD.

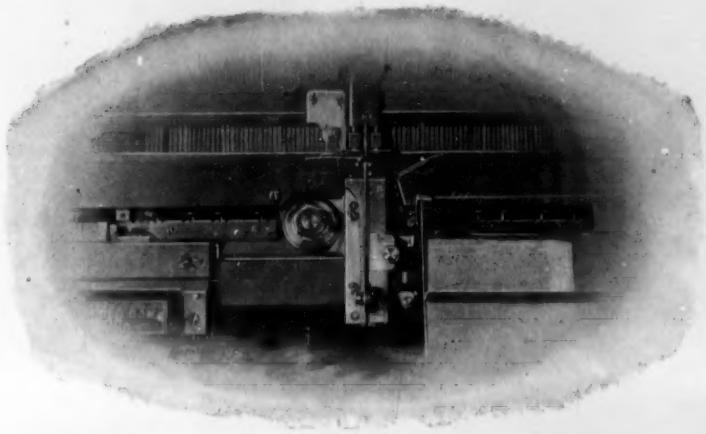
A Natural Zoo in Uganda.

Sir Harry Johnstone, the English special commissioner for Uganda, has recently returned to London after an absence of two years. He is going to propose to the English government that a stretch of country lying between Eldoma Ravine Station and the slopes of Mount Elgon, which contains the most extraordinary quantity of game that he has ever seen in tropical Africa, should be preserved as a national park or game preserve, similar to our Yellowstone. This district is entirely depopulated, the result of the terrible internecine wars of several years ago. It is now filled with all kinds of game indigenous to Central Africa, and the animals have been left unmolested for so long that they are quite as tame as if they had been kept in captivity.

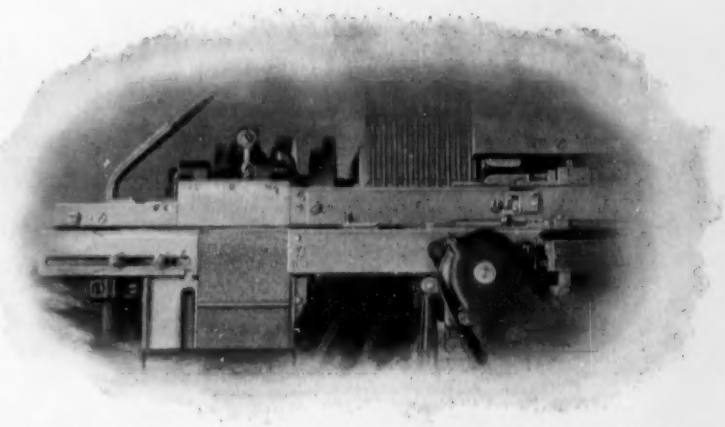
His caravan passed through vast herds of elephants and rhinoceri, while zebras and antelopes would even approach them within a distance of ten yards. Lions were also frequently encountered. It was in this district that the commissioner discovered the new specimen of giraffe, the male of which had five bosses or horn cores. The fourth and fifth horns protruded from the head just behind the ears at the base of the skull. Sir Harry Johnstone also met the extraordinary race of apelike men, first discovered by Mr. Grogan and Mr. Sharpe, on the borders of the Congo Forest. He secured several photographs and measurements to confirm his meeting with this simian race. These people, however, must not be confounded with the Congo dwarfs, who are quite a distinct race, since whereas the latter measure about four feet in height, the former are of normal stature.

A NEW TYPESETTING MACHINE.

Some of the best inventive genius in the United States has been devoted to the solution of the typesetting problem, as has been already noted in our description of the remarkable Paige typesetting machine, which was shown in the SCIENTIFIC AMERICAN for March 9, 1901. The system which we now illustrate was invented by Mr. Alexander Dow. The invention is the development of years of patient investigation as to the conditions which govern a satisfactory typesetting machine. The Dow composing machine uses foundry type of any size from five to twelve point, and the change of font from one size to another requires but a few minutes. The speed of the composing machine is limited only by the ability of the operator, the mechanism being normally set to allow a maximum of about 12,000 ems per hour. The system of composing involves the use of two machines; one composing machine which sets foundry types, character by character, line by line, and delivers them automatically justified on the galley, and the other a distributing machine, one of which will supply the magazines for about three composing machines. The latter are operated by one man each, and the power is usually obtained by a small electric motor. The type magazines will be seen directly above the keyboard. They are 4 feet in length and will contain enough type of the usual size to supply an operator for a day. The magazines contain three channels for the letter *e*, and two channels each for the other most used letters. Matter can be set up to a width of 5½ inches. The keyboard contains ninety keys placed in four banks, the arrangement being that of the universal keyboard in common use on nearly all typewriters.



ROTATABLE STICK RECEIVING LINE OF TYPE DURING COMPOSITION.

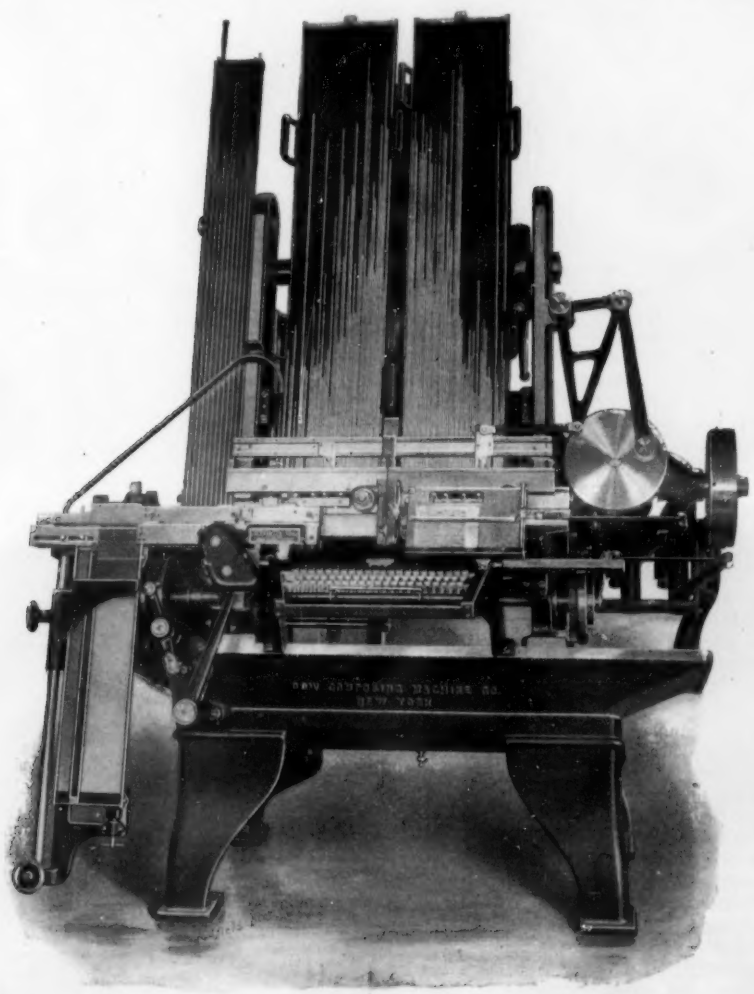


EACH WORD WITH THE JUSTIFYING SPACE BEING MOVED TO THE GALLEY.

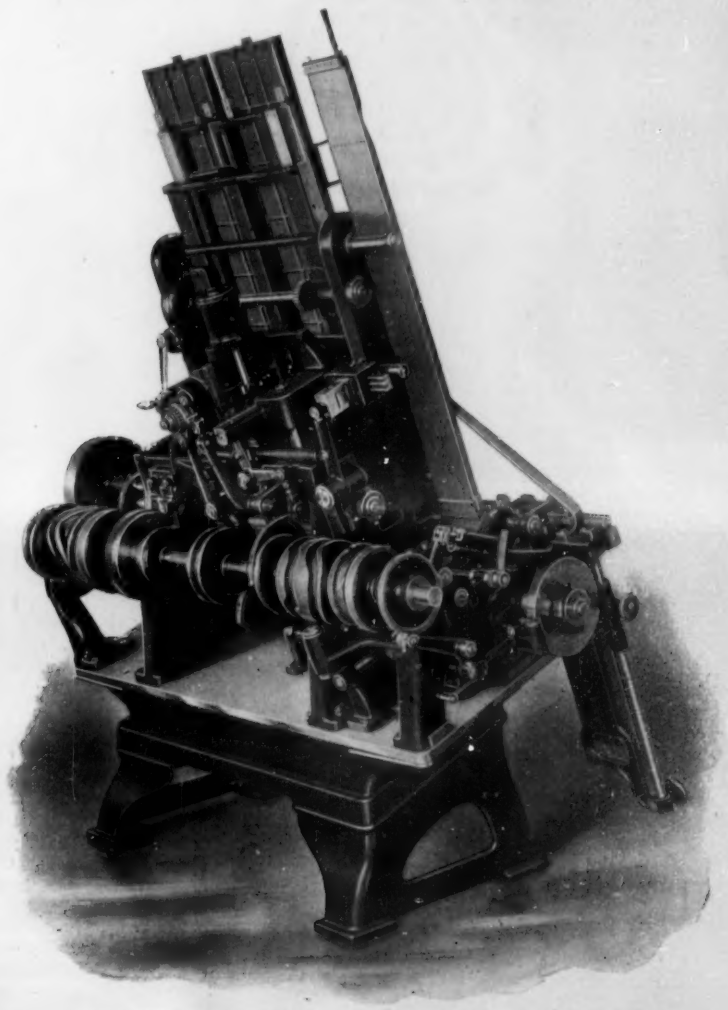
The operation of composing or setting the type consists in fingering the keys until the line approaches completion. Upon warning being given by a small bell, the operator completes or divides the final word of the line, touches the line key and continues the manipulation of the keyboard. The type feeds down into an upright channel called the "stick," which rotates so as to transfer the line to the raceway, which is horizontal. Here automatic mechanism measures the line and determines the proper combination of spaces necessary to justify it, separates the line into words, inserts the proper spaces in the line. The line is then automatically pushed into the galley and a lead or space between the lines may be inserted. All these operations go on without attention from the operator, who is composing the next line. With the aid of our detail illustrations the operation will be better understood. Most of the machines built heretofore have depended upon the weight or gravity of the types to carry them through certain portions of the mechanism. The individual types are so small that when wet or dirty they are apt to stick to the side of the channels, resulting in frequent stoppages. With the composing machine which we are describing this source of trouble is removed by the use of a positive-acting mechanism for moving the type at every point. The types are held in place and pushed or thrust through every movement. The types are assembled in the center at the foot of the two main magazines. Reciprocating pushers take the type to the center. Here a quick-acting blade thrusts the type into an upright channel called the "stick," which is shown in the first of our smaller engravings. Each type forces down the preceding one. As the types enter into the stick they are directly in front of the operator and may be read and corrected at will. Plain, rectangular bits of brass serve to separate the words temporarily. When the line is sufficiently full the operator touches the line key, and the stick turns quarter way around, so that the line is horizontal instead of vertical. The line is then pushed out by a blade to a point on the raceway called the "bridge," where the justification begins.

The most ingenious part of the whole apparatus is the justifier. It will be remembered that during the composition plain spaces of equal size have been inserted simply to separate the words temporarily. These have now to be removed to make place for permanent spaces of proper justifying size.

As each word is in turn forwarded to the galley, a proper justifying space is inserted before it until the



FRONT VIEW OF THE DOW COMPOSING MACHINE, SHOWING KEYBOARD, STICK AND TYPE MAGAZINES



REAR VIEW OF THE DOW COMPOSING MACHINE, SHOWING THE JUSTIFIER.

whole line in the galley is perfectly justified. Whenever the space-key is depressed, the fact is registered in the calculating device, which is seen at the rear of the machine, directly back of the magazine. When the line is ready to be sent to the justifying mechanism, its shortage is automatically measured and recorded by the calculating mechanism. The calculator having registered, say, six spaces for the line, and thirty-three hundredths of an inch space to be filled, sets in position the mechanism for ejecting six spaces, selecting them from the ten sizes in the space magazines, and they are then pushed into line as the words are separated. It will be seen that the keyboard operator need never consider justification at all, changes in the measure not even interfering with it, nor do the corrections made by hand. The whole operation of justifying a line occupies but a few seconds' time, so that the justified line is always out of the way before the operator can finish another line and present it to the justifying mechanism. When the last word of a line is reached the line is at once pushed down into the galley with the matter that precedes it. The machine is provided with various safety devices to protect it from accidents, broken type, etc.

The type matter which has been set can be used for printing direct or for electrotyping, and is then ready for distribution. The types are specially nicked for distribution. The dead matter is placed on the galley of the distributor in considerable quantity. The distributor, like the composing machine, handles the type irrespective of its condition. The galley mechanism presses the type firmly against the top, so that the upper line is lifted off and pushed into a raceway. From the forward end of this line rotating carriers take off the types with great rapidity and transfer them to the proper channels which radiate above the center of the distributor. Battered types or dirt in the nicks releases a suitable lock, which stops the machine and allows the operator to remove it without damage to the mechanism.

The general design and construction of the machine is in accord with the latest scientific knowledge. The cams are made on an especially designed machine that produces highly accurate results.

Oil for Marine Uses.

In spite of the experiments and dissertations upon the relative values of coal and oil as fuel, comparative tests are constantly made. The subject is so fascinating to engineers that they will not abandon it. A Dutch torpedo boat constructed by Yarrow & Co. was recently fitted up to burn both coal and oil as fuel, the latter being merely supplementary, to be used only when high speed is needed for a short time. The oil tank was carried on deck, so that in case of being struck during an engagement the oil would be discharged overboard instead of in the hold; steam was used to spray the oil through the burners, the loss of fresh water through this cause being slight, owing to the short time it was used. During the coal trial the boiler pressure was 150 pounds per square inch, with one inch water pressure, the engines making 350 revolutions per minute; the speed of the vessel was 24½ knots. Oil was then admitted into the boiler furnaces, coal still being burned at the same rate as before, with the result of increasing the pressure to 180 pounds, revolutions to 365 per minute, and the speed to 26½ knots per hour. The coal burned was at the rate of 2,800 pounds per hour, and oil at 700 pounds per hour. A great advantage of this combined use of coal and oil is that the speed can be increased at once by the admission of oil, so that dirty fires are no bar to pursuit of an enemy on sight.

"Novel" Motor Traction Engine.

Under this caption foreign technical journals describe an oil engine said to have been recently invented in Germany, but which, as regards type and general action, was first brought out in this country by the late Richard Dudgeon. Some of the details of the German engine may vary from that of Mr. Dudgeon's, and the agent employed as motive power—oil vapor—is different from the latter, for he used steam; but the system was devised forty years ago, and the writer saw it in action in this city, with Dudgeon driving it. The motor in question consists of a friction roller, or pinion, working on the inside of a larger wheel, such as a locomotive tire, for instance. The tire-tread runs directly on the road and suitable framing is provided to carry the engine. The device itself proved very successful as to tractive power compared with other methods, the advantage being given as 60 per cent in its favor.

In publishing in our issue of April 13 some photographs of the new Pacific Mail steamship "Korea," we failed to state that the engraving of the launch was made from a copyrighted photograph by Samuel E. Rusk. The omission was made inadvertently, and we now take pleasure in giving the proper acknowledgment, the neglect of which at the time of publication we greatly regret.

Engineering Notes

A carboniferous deposit has been discovered on the coast of Iceland. The coal is excellent in quality.

The Hamburg-American Line has arranged for a tank holding about 16,000 barrels, to be placed in the Hamburg petroleum harbor, for the storage of liquid fuel for the use of vessels of their line.

The London County Council have recently placed a new float upon the River Thames, driven by liquid fuel. By means of a large burner full steam is raised in a very few minutes. The special type of burner known as the Clarkson, which is utilized, vaporizes the oil, and then mixing the vapor with the air produces an intensely hot flame, which has the additional advantage of being almost smokeless.

Experiments are being carried out by the British Admiralty for the employment of liquid fuel in the smaller ships of the navy. A special system of burning the oil is being tried, in which the liquid is distributed on a bed of coal and firebrick by means of a steam spray and there ignited. The low-flash Borneo oil is being utilized, as it has been found preferable to the Russian oil for this purpose. Liquid fuel is much more advantageous and economical for small craft, but the greatest difficulty encountered is the maintenance of the steam pressure. Once this difficulty has been satisfactorily surmounted liquid fuel will be extensively employed in the navy.

During the submerged experiments with the French submarine boat "Narval," especially in those cases where the vessel has remained under water for a prolonged length of time, the crew have suffered from a peculiar sickness. It has been found impossible to account for this curious malady, and the Ministry of Marine has issued a regulation that all men in future recruited for submarine boats must undergo a rigorous medical examination. The sickness is believed to be due to constitutional causes, but doctors are now accompanying the submarine boats during the submerged trials to study the indisposition and to ascertain its cause if possible.

The new British Admiralty Board has on several occasions recently displayed its readiness to discard the cloak of conservatism which has so long characterized it, by introducing several new features, and by introducing modern plants in the shipyards. One of the latest evidences of this progress is the overhauling of the plant in Portsmouth dockyard, the premier shipbuilding yard of the country, and the installation of up-to-date American labor-saving devices. Most of the machinery at present in the dockyard is from twenty to thirty years old, and consequently is quite obsolete. An American pneumatic plant for riveting and drilling is to be attached to one slip, and if it proves thoroughly satisfactory further plants will be provided to the other building slips. Several electric calkers are also to be introduced, together with electric drillers, while the traveling cranes in the various departments will be driven by the same motive power. It is intended that electricity shall be utilized as the motive power in connection with all the heavy machinery.

In view of the agitation there is in this country for three-cent car fares, a brief account of the cheap traveling facilities in Europe is interesting. The facts have been collected by the British ambassadors in Germany, France, and Belgium respectively, and have been dispatched by them to the British Foreign Office, London, and published as a Parliamentary paper. Belgium offers the greatest and cheapest facilities for traveling. The state, which owns the railroads, issues five different types of tickets to the work people living in the neighborhood of the towns in which they are employed, including tickets, single or round-trip, for six and seven consecutive days per week, and tickets for one round journey each week, at considerable reductions upon the ordinary tariff. For a single journey of five miles on six days of the week, a total charge of fourteen cents is made, and for the six round trips twenty-two cents is charged. Traveling upon the surface street cars is cheaper still. In Brussels the company which controls the whole of the street tramways in the city is compelled to issue to workmen up to 8 A. M., and in the evenings between 7 P. M. and 8 P. M., single tickets on week days at a maximum charge of two cents any distance, including one transfer. When the tramways of Antwerp have been consolidated into one company, which will be accomplished in a few weeks' time, the same regulation will apply, and in this instance it will be possible for a man to travel 27½ miles for his two cents. In France the workpeople enjoy a reduction of 80 per cent upon the ordinary third-class fares upon the railroads. On the German imperial railways in Alsace-Lorraine the monthly commutation tickets for workmen average about one-fifth of a cent per mile, and on the Prussian state railroads, upon which weekly commutation tickets are issued, the rate is a fraction higher.

Correspondence.

Under the Lilacs.

To the Editor of the SCIENTIFIC AMERICAN:

Was it the attempted application of the doctrine of territorial expansion; was it a case of forcing a higher order of civilization upon an energetic and unwilling race; was it retaliation for real or fancied insult to national honor; was it, perhaps, because of an interest in the slave trade or a gold mine or a diamond field; was it any or none of these reasons that led to the terrific and decisive battles of which I was an interested witness some years ago?

It will perhaps never be determined what were the causes underlying a struggle of three days' duration, marked by carnage, feats of strength and deeds of valor such as it is rarely the lot of historian to record.

I was sitting one summer afternoon in the shadow of my cottage near a stunted lilac bush, when my attention was attracted to a horde of large black ants crossing a narrow roadway which lay between my house and that of a neighbor in the same yard.

Their objective point, I soon perceived, was the foot of the lilac, the ground around which had been honeycombed by little red ants less than half as large as the others. There seemed to be an unusual excitement here. Possibly a sentry or scout had brought news to the colony of the approaching army. At least they were not being attacked unawares. The invaders were met near the foot of the bush, and the war was on.

The battle ground was confined to a space perhaps three feet square, but here among the hillocks and ravines in miniature, all the tragedies and triumphs of war were enacted.

There was at first arrangement and order when van met van, but the conflict soon resolved itself into a general catch-as-catch-can encounter. Woe to the red ant luckless enough to get into the jaws of its larger foe. One closing up of those powerful instruments and a crushed, helpless mass was flung aside.

The smaller, however, had the advantage both in numbers and agility, and fought in pairs or triplets. Thus, while the black ant generally killed one or more of its antagonists, it was itself doomed.

The duration of a battle varied from five to fifteen minutes, when, all at once, hostilities would cease by the disappearance of the invaders, to be as suddenly renewed later.

It was pathetic during these periods of truce to note the casualties and the movements on the fateful field. Busy little army surgeons, or possibly members of the Red Cross corps, hurried from one mangled body to another. Sometimes a feeble response on the part of the wounded soldier to the anxious inquiry of the relief was noticeable. The solicitous and universal sympathy of the unharmed for their less fortunate companions was a sight never to be forgotten. The ground was strewn with bodies in all stages of dismemberment—legs gone, antennæ missing, head severed from the body, the body itself sectioned. Here and there one mortally wounded dragged itself slowly and painfully to some obscure spot to die. Others were helped away to a place of security, but in such a condition that it is safe to infer they passed their remaining days in a hospital or some home for the disabled.

For three days in at least as many battles each day the conflict raged. Each day witnessed a perceptible thinning out of the ranks, but the vigor and spirit of the contest kept up till near the close.

Desirous of knowing what effect the presence of strange surroundings would have on the combatants, I procured a large glass dish and captured several of both species. This I repeated at various times. Invariably, while at first trying to escape, upon becoming aware of each other's presence they grappled and fought to the death. Valor, honor, hatred, revenge (What was it?) dominated entirely over fear.

Against the stubborn resistance and greater numbers of their antagonists the invaders could not hold out. A panic finally seized the survivors such as comes upon human warriors—an unutterable, unreasoning fear, and, thoroughly defeated in their object, whatever it might have been, for days after hostilities ceased any unusual noise near their dwellings would send each individual hurriedly to shelter as if an avenger were at its heels.

The evidences of war having been removed from the battlefield, the stunted lilac once more towered above homes in which thrift and courage went far to redeem the losses and promised a future over which no gloom could cast a shadow.

Muncie, Ind. M. M. SHERRICK.

Successful Trial of the Santos-Dumont Balloon.

The motor-driven balloon of M. Santos-Dumont had a trial on July 12, the voyage being from St. Cloud around the Eiffel Tower at Paris and return. According to cable reports the speed was about 37 miles an hour. The height of the balloon above the ground varied from 320 to 890 feet. The aeronaut descended successfully six times upon foreordained spots.

TWO OF THE LATEST TYPES OF BATTLESHIPS.

It is evident, even to the casual student of naval matters, that the once clear line of demarkation between the battleship and the cruiser is likely, in these latter days, to disappear altogether, the two types becoming merged in a vessel which is distinguished by possessing, in the highest degrees, the qualities of size, speed, armor and armament.

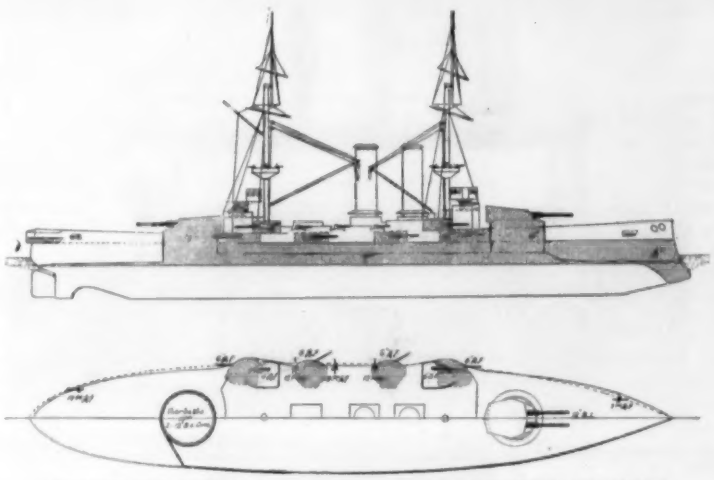
We illustrate on the front page of this issue two of the latest designs for battleships, one representing the "Duncan" class of the British navy, and the other the "Peresviet" class of the Russian navy, both of which illustrate the tendency above referred to.

THE BRITISH BATTLESHIP "DUNCAN."—The "Duncan" represents the commonly accepted ideas as to what features should be embodied in a first-class battleship, and in her speed and the disposition of her armament she is not unlike our own vessels of the "Pennsylvania" class, although the latter are considerably more powerful. In the "Duncan" we see the direct descendant of the original "Royal Sovereign" type of 1892, with such modifications introduced as have been suggested by the progress of naval design during the past decade. The "Royal Sovereign" was of 14,150 tons displacement, 17½ knots speed, with 18 inches armor on the side and 17 inches on the gun positions; an armament of four 13½-inch, ten 6-inch guns and sixteen 6-pounders; and a bunker capacity of 1,800 tons of coal. Following her came the "Majestic," launched in 1895, of 14,900 tons displacement, 17½ knots speed, and the same bunker capacity, carrying 9 inches of Harveyized armor on the sides and 14 inches on the gun positions, and armed with four 12-inch wire guns, twelve 6-inch rapid-firers, and eighteen 3-inch rapid-firers. Then came the "Canopus" type, launched in 1898, of 12,950 tons displacement, 1,800 tons bunker capacity, 18.25 knots speed, and the same armament as the "Majestic," but with armor reduced to 6 inches of Harveyized steel on the belt and 12 inches on the gun positions. The "Duncan," which is now under construction, is, therefore, a direct improvement upon the "Canopus," having 1,000 tons more displacement and the same battery, but 19 knots speed, as against 18.25, while her bunker capacity has been raised to 2,000 tons. The defensive qualities are vastly greater, 7 inches of Krupp steel taking the place of 6 inches of Harveyized steel on the belt, and the gun positions being protected with 11 inches to 6 inches of Krupp steel, as against 12 to 5 inches of Harveyized steel in the case of the "Canopus." The 7-inch side armor of the "Duncan" extends over 290 feet out of her total length of 405 feet, and it is continued, with a gradual decrease in its thickness forward, to a minimum thickness of 3 inches at the bow. Protection is further assured by two steel decks, the lower turtle-backed deck being 2 inches in thickness, and the deck above it 1 inch in thickness. The main armament consists of four 12-inch wire guns, carried in two barbettes plated with 11 inch Krupp steel, and twelve 6-inch rapid-fire guns carried in casemates, eight of them on the gun deck and four on the main deck. Of these 6-inch guns, four will be able to fire dead ahead and four dead astern. Although the "Duncan" is an admirable design, altogether we think that the efficiency of the 6-inch battery would be greatly increased if the 6-inch plating in the wake of the 6-inch guns on the gun deck were continuous, instead of extending only in the wake of each gun position.

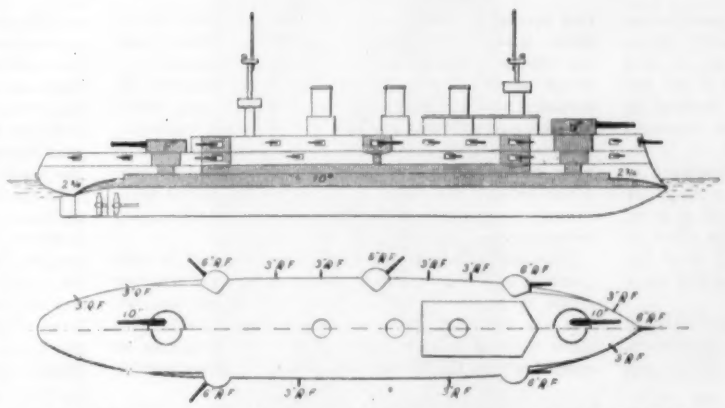
Judged from an American standpoint, the armament is rather light for a vessel of 14,000 tons displacement, although it must be remembered that there are compensating features in the high speed and the large coal supply. Our own vessels of the "Georgia" class, illustrated in the SCIENTIFIC AMERICAN of November 17, 1900, although of only 1,000 tons greater displacement, are of equal speed and much more heavily armored; and also in addition to carrying the same number of 12-inch and 6-inch guns, they will have an intermediate battery of eight 8-inch rapid-fire guns.

THE RUSSIAN BATTLESHIP "PERESVIET."—The Russian navy, like that of France, is remarkable for the wide diversity of types which exists among its battleships; indeed, it may be said that Russia has shown more originality, and is answerable for the introduction of more novelties of design, than any other naval power. The "Peresviet," with her sister ships "Oslabya" and "Pobieda," combine the qualities of the battleship and cruiser. They are unlike any other ships of recent construction, although the speed of 18 knots is rather low in these days for a cruiser-battleship, a type which in the Italian designs as represented by the "Regina Elena" class, is to have a maximum speed of 23 knots an hour. The "Peresviet" is distinguished from all preceding vessels of the Russian navy by being driven by triple-screw engines, and it is also the first of the Russian ships to carry the 6-inch rapid-fire guns of the secondary battery in separate armored casemates. A noticeable feature in these ships is the extremely high freeboard; the two forward 10-inch guns must have a command of over 33 feet above the water. A thoroughly characteristic feature is the large number of 3-inch guns which are carried, there being no less than twenty of these very formidable little weapons; indeed, the Russians in their later ships show quite as strong a preference for extremely heavy batteries as we do in the United States.

The "Peresviet" and class are 434 feet 6 inches long, 71 feet 6 inches beam and draw 26 feet of water. They are expected to develop their contract speed with an indicated horse-power of 14,500. Their coal supply is very liberal, for on a displacement of 12,674 tons they will carry a normal coal supply of 1,063 tons, and a maximum bunker capacity of 2,056 tons. The protection is very clearly shown in the accompanying diagram. In consists of a belt of 10 inch Harveyized steel, associated with a 2¾-inch protective deck. This belt will be carried up on either side to the main deck for a length of about 250 feet amidships. The main battery of four 10-inch guns is mounted in two turrets, protected with 9 inches of armor. The 6-inch rapid-fire guns of the secondary battery, of which there are eleven, will be disposed as follows: four on the gun deck in armored casemates with arcs of fire from abaft the beam to dead ahead and dead astern; four on the main deck, immediately above the guns just mentioned, the walls of the casemates being vertically flush with those on the deck below and the guns having the same arcs of fire. Two other 6-inch guns will be carried in casemates amidships, as shown in the diagram, and one will be carried on the same deck forward in the bow, its port being cut through the stem. There will be ten 3-inch rapid-fire guns on the gun deck and ten on the main deck. The vessel carries six torpedo tubes; and it should be mentioned that there is a powerful electric installation on board, both for lighting and for such purposes as hoisting shells, turning turrets and similar operations incidental to the working of a battleship. The military masts are short but powerful, and there will be a numerous battery of twenty-seven 3-pounders and 1-pounder guns distributed throughout the superstructure and the military tops. These vessels, as may be judged from our illustration, present an exceedingly ship-shape and well-balanced appearance, and to our thinking are among the handsomest naval designs which have been turned out in recent years.



BRITISH FIRST-CLASS BATTLESHIP "DUNCAN." CLASS OF SIX SHIPS.



RUSSIAN FIRST-CLASS BATTLESHIP "PERESVIET." CLASS OF THREE SHIPS.

A Spider's Genius.

I have considerable respect for the female spider, notwithstanding the fact that she does not treat the male very considerately. I had an opportunity last summer to watch a large one that had a web in the top of a decaying peach tree with so few leaves that it was in plain view. I caught sight of her first when watching some birds with my glass. She seemed to be climbing from the top of the tree on nothing to a telephone wire some fifteen feet away and somewhat higher than her web. When she reached the wire she went around it and then back. In studying the situation, I found the web was so located that it required a cable to hold it up, and the spider had in some way got one over the wire so far away. This cable was, of course, a slender silken thread which evidently she had thrown out, and on account of its lightness it had floated to the right place and become attached there by its glutinous properties. It seems remarkable that it should have adhered to the wire firmly enough to allow so large an insect to climb over it, which she did every day as long as I watched her, evidently to mend or strengthen it. The spider must have brains in which the ability to construct its web and adapt it to conditions is highly developed. In an article in Chambers's Journal the following account of how the spider forms its silken threads is given:

"One of the most interesting features in the economy of spiders is their power of emitting slender threads of a silk-like substance called gossamer, with which most of them construct mesh-like nets, and a few long, dangling cables, by which they are buoyed through the air with nearly as much facility as though they had been furnished with wings. The apparatus provided by nature for elaborating and emitting this gossamer is a beautiful piece of mechanism. Within the animal there are several little bags or vesicles of a gummy matter; and these vesicles are connected with a circular orifice situated at the abdomen. Within this orifice are five little teats or spinnerets, through which the gossamer is drawn. It must not be concluded, however, that there is only one film of gossamer produced by each spinneret; the fact is, these teats are studded with thousands of minute tubes too small for the naked eye to perceive, and each of these emits a thread of inconceivable fineness. These minute tubes are known as spinerules, and the films which proceed from them unite like so many strands of a rope to form the thread of gossamer by which a spider suspends itself. The finest thread which human mechanism can produce is like a ship's cable compared with the delicate films which flow from the spinnerules of the largest spider. The films are all distinctly separate on coming from the spinneret, but unite, not by any twisting process, but merely by their own glutinous or gummy nature. Thus the spinning apparatus of the disdained spider, when viewed by the eye of science, becomes one of the most wonderful pieces of animated mechanism known to man. The animal has great command over this apparatus, and can apply it at will as long as the receptacles within are replenished with the gummy fluid, but as soon as this gum is exhausted all its efforts to spin are fruitless, and it must wait till nature, by her inscrutable chemistry, has secreted it from the food which is devoured."—Dr. M. L. Holbrook in the Phrenological Journal.

Messrs. Denny Brothers, of Dumbarton, Glasgow, the builders of "Shamrock II.," are constructing a steamer to ply upon the Clyde equipped with the Parsons steam turbine system. This is the first passenger steamer to be propelled by this means. The vessel will be ready for launching shortly, and the experiment will be closely followed by the various steamship companies plying across the English Channel. The French Northern Railroad Company are particularly interested in the scheme, and if the experiments upon the Clyde prove successful, they will introduce the turbine steamer upon their services. Such an innovation will revolutionize the cross channel traveling. The boat will have a speed of 30 knots and will cover the 22 miles between Calais and Dover in a little over half an hour, whereas at present it occupies one hour. By this means the service from London to Paris will be considerably accelerated.

MARCONI'S WIRELESS TELEGRAPHY AUTOMOBILE FOR MILITARY PURPOSES.

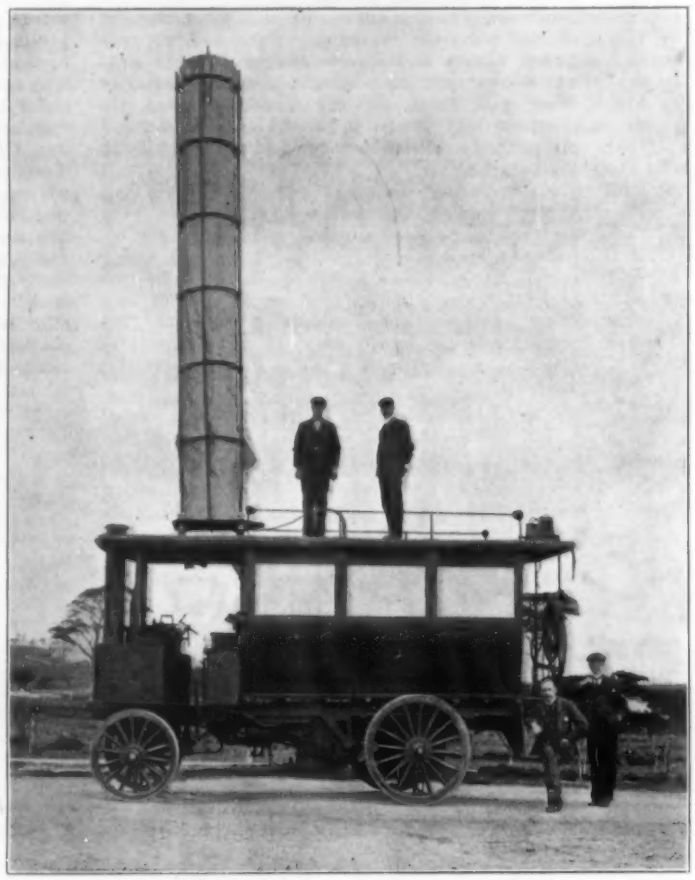
BY ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

It will be recollected that during the earlier stages of the war in South Africa the British forces utilized Marconi's wireless telegraphy for the purposes of communicating between various army detachments and for the transmission of messages. The experiment was not attended with very conspicuous success and was shortly afterward abandoned. The cause of the failure was not due to any defect in the system, nor to the presence of minerals in the earth, as was generally supposed, but was entirely due to the inefficiency of the military department.

When the war broke out the military authorities decided to install the system at Cape Town for the purpose of telegraphing the arrival of the various transports to some point inland. The operators were sent to Cape Town, but upon their arrival there the military authorities requested them to proceed to the front. The operators acceded to the desires of the War Department, and went to the front. When the men reached the scene of action they were unable to secure poles to which to attach the aerial wires, and as there were no trees within miles they could not improvise masts. They thereupon requisitioned Major Baden-Powell's military kite, but even then the results achieved were very unsatisfactory. Marconi himself has no confidence in the kite for this purpose, owing to its remarkable vagaries and liability to fall to the ground. Under these circumstances the military wisely decided to dispense with the system; but that its failure was simply due to insufficient preparation is borne out by the fact that whenever an elevation was obtained the messages were received and transmitted without the slightest hitch.

In view of the inconvenience that had been caused by the absence of the necessary poles Marconi decided to construct a portable installation which would be specially adaptable to military requirements. For some time past he has been experimenting with huge cylinders to act as receivers in lieu of the high wire. These cylinders have been proved to be more efficacious for the transmission of messages over short distances, than the ordinary apparatus. When the electric currents are excited, the waves at first oscillate very rapidly and violently, but in a few moments the vibrations die down, or become damped, in much the same way as the wire of a piano decreases its vibrations after a note has been struck. It is imperative that these vibrations should be sustained as much as possible, in order to travel over a long distance, and to ensure this end you must have a great capacity in your sending instruments. The effect of the cylinder is to render greater capacity than the ordinary aerial wire, and consequently you obtain more sustained vibrations.

The apparatus that Marconi has devised for military purposes is shown in our accompanying illustration. The automobile is the Thornycroft steam motor car, or lorry, which is now so much used in England for heavy road traffic. The car has a capacity for about five tons, and can attain a speed of from twelve to fourteen miles per hour with a full load. The rear part of the lorry is fitted up as an operating room, containing instruments and electric batteries. Upon the roof of the car the long cylinder is placed. In our photograph the cylinder is raised ready for use, but when not required it is laid down flat upon the roof, out of the way. The cylinder is about twenty-five feet in height. It is constructed of metal and thoroughly insulated. The points from which the currents are transmitted into, and received from, space may be plainly observed at the top of the cylinder, and the wires connecting them with the instruments below. The cylinder can be raised or lowered instantaneously. The car, owing to the strength and stability of its construction, is a typical vehicle for military work where rough roads are encountered.



MARCONI'S MILITARY AUTOMOBILE EQUIPPED WITH THE CYLINDER SYSTEM OF WIRELESS TELEGRAPHY.

One special recommendation of this migratory installation is that communication can be maintained while the vehicle is traveling. The maximum distance over which messages can be dispatched and received by means of this installation is 20 miles at present, which is generally sufficient for military purposes. Marconi, however, is still continuing his experiments with a view to increasing this distance. The cylinder performs exactly the same functions as the aerial wire, even in connection with the tuned or synchronized messages.

This automobile is the first to be equipped in this manner, and it has been subjected to several exacting trials to prove its efficiency. The military authorities are following the experiments very closely, and since there is a keen desire to utilize the system as extensively in the British Army as it is being requisitioned in the British Navy, there is no doubt that they will avail themselves of this car. The question has simply resolved itself into the designing of a portable, light, yet strong apparatus, simplified as much as possible for easy transport. For military purposes such an installation must be conveyed in such a manner that it can be ready for use at a moment's notice. It would be absolutely useless to carry an extensive plant, together with a sufficiently high mast to carry the aerial wire, for a valuable waste of time would necessarily ensue in getting the apparatus into working order. This automobile offers all the desired advantages, and the raising and lowering of the cylinder instantly at will is a sufficient recommendation for the utilization of the invention.

Although Marconi is still continuing his investigations with the cylinders, his principal experiments are still concerned with the perfection of the original system, an improvement upon which has not yet been discovered. Although Marconi has found the cylinders to be specially valuable for the transmission of messages over short distances, up to about thirty miles, it has not been found so successful in the case of long distances.

THE FIRST PASSENGER TURBINE STEAMER "EDWARD VII."

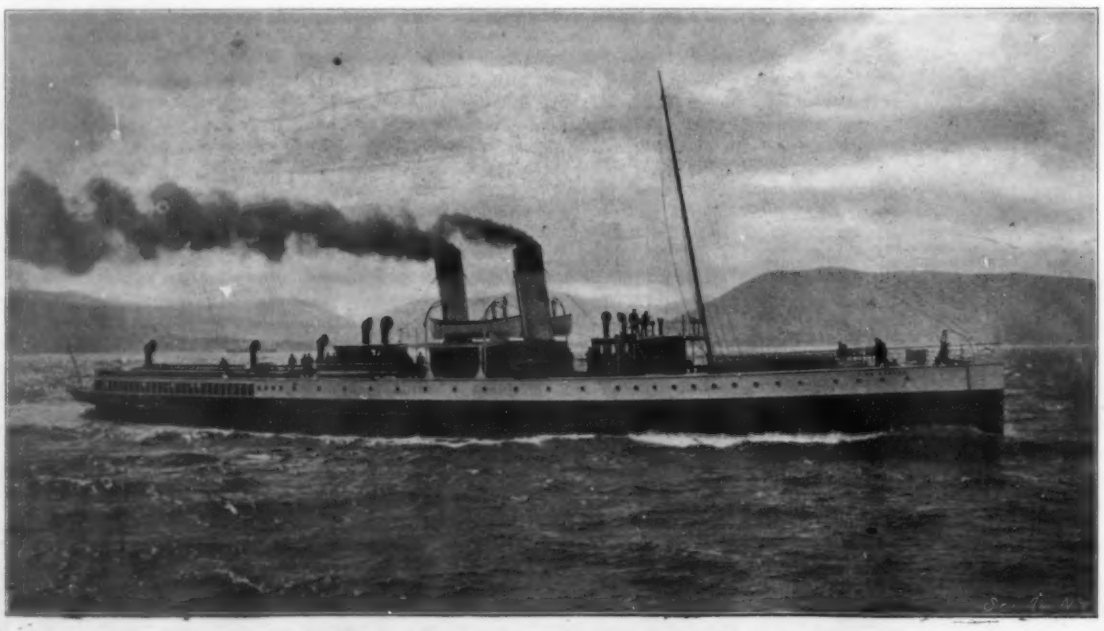
BY OUR ENGLISH CORRESPONDENT.

After the satisfactory results obtained from steam turbines in driving vessels of the torpedo-boat type, it was inevitable that this system should be tried in other vessels where high speed was desired. The first attempt to utilize this method of driving for a passenger vessel has just been made on the Clyde in the steamer "King Edward," of which we are able to give herewith a photograph specially taken for us on her first trial run. The "King Edward" has been built by Messrs. William Denny & Brothers to designs by their own draughtsmen, working in combination with the Hon. C. A. Parsons, and she is intended for service between Fairlie and Campbelltown.

There is very keen competition for the passenger-carrying traffic on the Clyde, three different railway companies being interested, and the boats engaged are the finest river steamers in Britain. This seemed to offer a promising field in which to test the turbine principle, but the Parsons Marine Steam Turbine Company failed to induce any of the competing companies to experiment with the turbine. The project seemed likely to be shelved, when Messrs. Denny took the matter up, and in conjunction with the Parsons Company and Capt. Williamson agreed to build the vessel as an independent experiment.

In the hull of the boat there is comparatively little calling for special attention, although it is evident at a glance that she has been lined in such a manner as to give the turbines the greatest possible opportunity for making a record in speed. The model of the hull carries more than a suggestion of the torpedo-boat form, although it has been modified to suit the passenger trade. She has a shallow-draught hull of exceptionally fine entrance and run, with the beam carried well forward. There are three propeller shafts and five propellers, two of them being carried on each of the side shafts, and a larger one on the central shaft.

It is in the machinery, however, that the chief interest of the boat lies. It consists of three turbines, all separate, and each driving one of the shafts. The high-pressure turbine is placed on the center shaft, and each of the low-pressure turbines drives one of the outer shafts. Inside the exhaust ends of each of the latter were placed the two astern tur-



THE FIRST PASSENGER TURBINE STEAMER, "EDWARD VII."

bines. In driving ahead in the ordinary way, the steam from the boilers is admitted to the high-pressure turbines, and after expanding it about five-fold, it is passed to the low-pressure turbines, where it is expanded about twenty-five-fold more and then passed on to the condensers. This gives a total expansion ratio of about 125-fold. At twenty knots speed—and this has already been obtained without any excessive driving—the speed of the center shaft is 700, and that of the two outer shafts 1,000 revolutions per minute. When coming alongside a jetty or maneuvering in a harbor, the outer shafts only are used, and steam is admitted by suitable valves directly into the low-pressure motors, or into the reversing motors independently on either side of the vessel. The high-pressure turbine under these circumstances revolves idly, its steam admission valve being closed, and its connection with the low-pressure turbines being also closed by non-return valves. By this arrangement great maneuvering power has been secured. Up to the time of writing there have been several trials of the vessel, and the engineers declare themselves as perfectly satisfied with her last test. She easily made twenty knots, and even at this speed there was a noticeable absence of vibration. The comparatively small space occupied by the engines leaves large accommodation for passengers—a consideration of much value in the trade in which she will be engaged.

PREPARING A SERI MEAL.

THE MOST PRIMITIVE AMERICAN SAVAGES.

BY WALDON FAWCETT.

After centuries of ineffectual effort to penetrate their rigid exclusiveness, something is at last coming to be known regarding that strange people, the Seri Indians, the fiercest Indians on the American continent and unquestionably the least-studied and most completely isolated race of people on the globe. There is something almost pathetic in the fact that what little information has been gleaned by the Bureau of American Ethnology, a branch of the United States government, has been secured on the eve of the total extinction of this, the most strongly marked and distinctive of the aboriginal tribes of the New World. For hundreds of years these savages, in many respects the most terrible fighters the world has ever seen, have been continually at war with their neighbors until now the population of the tribe, which a couple of centuries ago numbered several thousand, has been reduced to little over three hundred persons, of whom not more than seventy-five are adult males or warriors. The great dominant characteristic of the Seri is their absolute isolation in thought and life and feeling. It has no counterpart on earth to-day. More impressive still is the fact that the ages of life in their own little sphere, almost as completely isolated as though they inhabited another planet, have fostered in the Seri a bitter and implacable hereditary enmity toward all other human beings. All the mistrust and hatred which it is possible for one race to feel for another culminates on the borders of Seriland. The nearest neighbors to the Seri regard them as hardly human—a feeling fully shared by the Seri themselves, who deem themselves more closely akin to the beasts which they worship than to the despised humans haunting their borders. In very truth they stand alone in every respect, far out-Ishmaeling the Ishmael of old on Araby's deserts.

The geographic position of the Seri domain and its physical features assist these Indians, if not, indeed compel them to live a people apart from all the world. They inhabit Tiburon Island in the Gulf of California and a very limited area on the adjacent mainland of Mexico. Their little principality is protected on one side by stormy seas in which any craft must wage a hard fight for life and on the other by almost impassable deserts. Their home itself is too hard and poor to tempt conquest, being arid and rugged and consisting chiefly of desert sands and naked mountain rocks with permanent fresh water in only one or two places. Finally their possessions are too meager to invite spoliation, but did they possess the treasures of the Aztecs they would be almost equally secure, since the natural terrors of this modern inferno would be likely to exterminate any civilized force which might attempt an invasion.

FULL-BLOODED SERI.

Both the Seri men and women are of splendid physique, they have fine chests with slender but sinewy limbs and are notably vigorous in movement, erect in carriage, and remarkable for fleetness and endurance. The members of the tribe subsist almost wholly on sea food, land game and fruits, and most of their food is eaten raw. They neither plant nor cultivate, and are without domestic animals save dogs, and these latter are little short of wild beasts. Their only habitations are flimsy bowers of shrubbery, occasionally shingled rudely with turtle-shells and sponges. The Seri clothing consists of a kilt or skirt extending from waist to knees, and the women indulge in the most fantastic symbolic face-painting.

At present polygyny prevails in the tribe, but in former years polyandry was practised. The primary marriage is negotiated between the mothers of the would-be groom and the prospective bride. If the mother and daughter in the latter family look with favor on the proposal, the candidate is subjected to rigorous tests of character, and if these are successfully passed the marriage is considered complete and the husband becomes a privileged and permanent guest in the wife's household. In every phase of the life of these people there crops out their intense, fiendish hatred of all other human beings. In their estimation the brightest virtue is the shedding of alien blood, and the blackest crime on the Seri calendar is conjugal union with any person from the outside world.

These Indians, who have for centuries successfully stayed Spanish, Mexican and American invasion, worship innumerable mystical deities, most prominent among which are the pelican, the turtle, moon and sun. It is known that there are certain observances at the time of the new moon and that there are held annual ceremonies at various times, but the character of these no white man has ever been able to ascertain. How great is their secretiveness may be imagined from the fact that to this day no alien has ever seen the christening of their children, the burial of their dead or the ceremonies of their shrines.

In the olden days the Jesuit missionaries and after them the Franciscan friars and the secular officials sought to scatter the Seri by both cajolery and coercion, and endeavored to divide families by restraint of women and children and by banishment of wives. There are traditions, too, of the capture and enslavement of Indian and Caucasian women in Seriland, yet the fact remains that not a single mixed-blood Seri is known to exist, and not more than two of the blood now live voluntarily beyond the confines of the tribe, and these have been outlawed and could not return to their people if they wished.

It is impossible for a person who has not traveled through the country to understand with what mingled horror and terror and loathing the Seri are regarded through the length and breadth of western Mexico and in the southwestern portion of the United States. Their practices in warfare have afforded repeated proof that they are not only the most primitive but by far the most bloodthirsty and treacherous of the Indians of North America. Even at the present time, with their wasted forces, it would be little short of suicide for even a Mexican official to visit these Indians or land on their island without an armed guard. Any white man, Mexican or Indian of another tribe coming in contact with them is killed without the slightest compunction unless they are restrained by fear.

GROUP OF SERI INDIANS.

In warfare they make use of the deadly poisoned arrows, and although the United States government explorers have virtually established the fact that these Indi-

ans do not practise cannibalism, as had been supposed until a few months ago, it is known that they habitually indulge in carrion eating. Added to these other grewsome details is the supreme horror which has been inspired by the accounts of offense and defense by nails and teeth which have been given by men who have met the Seri in battle. Such is the shuddering antipathy aroused by these bloodthirsty chronicles that, incredible as it may appear, many of the more timid neighbors of these wildest of Indians stand in greater dread of the natural weapons than of the brutal clubs and swift-thrown missiles of the Seri or even of their poisoned arrows.

The potency of the magical mystery which surrounds the Seri could not be more forcefully illustrated than by their relations with their nearest neighbors, the Papago Indians. The Papagos are known as among the most fearless and ferocious fighters in old Mexico; and yet when the United States government officials planned the recent expedition which has finally resulted in giving to mankind some little knowledge of the world's least-known inhabitants, it was only after tremendous efforts, in which threats and persuasion were mingled, that a few picked Papagos were induced to accompany the expedition as guards.

The Papago Indians were not only ready but wildly eager for fray if it could but be carried on at the frontier, but they shrank back in unmistakable dread from an actual invasion of the territory of their hereditary enemy as though it were some sacred realm, mere entry into which would bring down the annihilating wrath of the gods. At the outset the expedition was beset by storms, and all the powers of earth and air appeared to be arrayed against the enterprise, all of which the poor Papagos declared to be but just punishment for a sacrilegious infraction of an ancient law. The strain upon the women who had been left behind was fearful to behold, and the wife of one of the guards collapsed under the tension and died of her terrors. To all the Papago women and many of the men the safe return of the party was as the rising of the dead.

In the case of the Seri visited by the official investigators from Washington there were disclosures not less striking. A few of the men of the tribe had at some time in their lives made the three days' journey across the desert to a frontier post where a few white men are stationed, but none of the women or children or the young men had ever before beheld a Caucasian. The Seri were somewhat awed by the sight of the white men, but the presence of the Indians who had accompanied the expedition as guards produced a radically different effect. The explorers even found it necessary to keep the Papago interpreter and others of the tribe at a distance, for the mere sight of these inimical tribesmen threw the Seri women and children in a paroxysm of fear. The women huddled into circles facing outward, and some of them were deathly sick for days afterward as a result of the fright.

Strangely enough the Seri, whom the other Indians and Mexicans regard very much as a man does a rattlesnake, are among themselves fairly cheerful, and the families are unobtrusively affectionate, but the cheerfulness is instantly banished upon the approach of an alien. There is ground for the belief that the Seri systematically exterminate weaklings, and indeed did they not do so the literal races for life in which the bands now and then engage would be attended with far more serious consequences than is the case.

The fleetness of well-developed Seri and the powers of endurance possessed by young and old alike are simply astounding. Instances are on record where Seri hunters have actually run down and captured alive full-grown bucks, and they think nothing of capturing a frightened horse tearing forward at full speed. Knowing of their prowess in this direction, an enterprising Mexican conceived the idea of exhibiting several Seri as deer catchers at different European expositions, but all efforts to tame the Indians sufficiently for the purpose were unavailing.

The record of the warfare carried on by the Seri would form a most blood-curdling recital. None other of the aboriginal tribes of America has so sanguinary a history, and none other has at once so long and bloody a record. The principal Seri weapon is the arrow, and each arrow-tip is dipped in a horrible charm-poison composed of the most deadly creatures which exist—the fanged heads of serpents, the stinging tails of scorpions and the fiery feet of centipedes. The Seri do not know the meaning of open warfare or face-to-face fighting. Their favorite tactical device is ambuscade; their warfare is wholly treacherous and cowardly in design and craven and cruel in execution.

Once the battle is begun the Seri warriors either discharge clouds of arrows from their places of vantage, or if they have helpless, unarmed men to deal with, rush forward to brain their victims with stones or to break their necks and limbs. Under such circumstances the rushing warriors are transfigured with frenzy; their eyes blaze purple and green, their teeth glisten through snarling lips, their hair half rises in bristling mane, while their chests swell and their lithe limbs quiver in a fury sudden and blind and overpowering. Should the assault be unsuccessful, however, the beaten warriors, their blood-frenzy quickly burned out, skulk silently behind rocks and shrubs or retreat across the sands with inconceivable fleetness.

TYPICAL SERI HOUSE.

Relation of the Mosquito to Malaria.

At a meeting of the National Biological Society, held November 19, 1900, Dr. C. W. Stiles, of the Department of Agriculture, read a paper, says the Chicago Record, advancing the theory that mosquitoes were entirely responsible for the disease we call malaria, and that without mosquitoes there would be no such disease.

"From a medical, biological and economic standpoint malaria is one of the most important diseases of man," said Dr. Stiles this morning. "The number of deaths annually from this disease throughout the world must be reckoned in hundreds of thousands, Italy alone averaging about 15,000 a year, while the number of sufferers must be counted by millions. Its economic importance may be appreciated when we take into account not only the deaths, but the time lost by those who are afflicted. From a military standpoint it is also important, since in some localities 40 or 50 per cent of the troops suffer with malaria every year.

"The cause of the disease was discovered in Africa by Dr. Laveran, a French surgeon, twenty years ago. He is at present engaged at the Pasteur Institute, Paris. He discovered in the blood a microscopic organism which he first thought was a plant belonging to the genus Oscillaria, but which has since been recognized as animal and placed in the genus Plasmodium. Three distinct species are known—one which takes only forty-eight hours to complete its cycle in man. That is the cause of the ordinary tertian fever, where the patient has a chill on alternate days. The second form takes seventy-two hours to complete its development, and is the cause of the quartan fever. The third form is the cause of the so-called irregular estivo autumnal fever.

"Although the parasite was discovered twenty years ago, it is only within two years that its life history has been worked out. This is exceedingly complicated and has a direct bearing upon the origin of malarial infection. It contradicts many popular ideas regarding malarial diseases, and it will take some time to convince the public that the conclusions are correct. However, there is absolutely no ground for skepticism. The parasite runs through a double cycle, and thus appears to us in two distinct forms. One cycle is present in the blood of the human being, and is the cause of disease. This microscopic organism is known as an asexual animal—that is, males and females cannot be distinguished. The other cycle is found in certain mosquitoes of the genus Anopheles. In this stage the animal is sexual, and males and females can be clearly distinguished. The parasite takes a position in the wall of the mosquito's stomach and there forms minute germs known as sporozorites, which gradually work into the glands of the insect. Then whenever the mosquito bites a person she leaves a few germs under the skin. Only female mosquitoes attack human beings, the male mosquitoes feeding upon vegetable matter. These germs, running through the asexual stage in the human being, reproduce so rapidly that the ordinary parasite of tertian fever gives life to about 560,000,000,000 within twenty days' time. If we would exterminate malarial diseases mosquitoes must first be exterminated, for it is impossible for the parasite of malaria to complete its work without the aid of the mosquito.

"While there is a popular impression that mosquitoes have something to do with malaria, people generally believe that malaria is caught either from breathing swamp air or drinking impure water. It must therefore be expected that the results of recent scientific investigation will be doubted. Biologically, however, there is only one exception to the law that malaria is transmitted by mosquitoes. If a person in a certain stage of malaria should happen to be attacked by a biting fly or some other insect, and that insect should infect a healthy person with malarial germs, it might develop a case of malaria. Such an occurrence, however, would be exceptional.

"It sounds radical," continued Dr. Stiles, "to assert that the existence of malarial diseases is absolutely dependent upon mosquitoes, but the sooner the fact is realized the sooner we will get rid of these diseases. Man is not the only animal that has malaria, but no other has the same malaria found in man. A large percentage of sparrows, swallows and pigeons have a disease which corresponds to malaria, but it is not transmissible to man.

"I have heard it suggested that in some regions where mosquitoes are plenty malaria is unknown, and that malaria exists where there are no mosquitoes, but in plenty of places where man exists yellow fever is unknown. Other conditions must prevail to produce malaria besides the presence of man. We must have man present for the disease to develop; secondly, we must have mosquitoes of the genus Anopheles to transmit the disease, and, thirdly, the germs which cause the disease. You can have mosquitoes and man in a given locality, but if the germs are not present the disease will not exist."

"Can you prove that malaria is not transmitted by the air or by drinking water?" Dr. Stiles was asked.

"This involves the demonstration of the negative," he replied. "It is impossible to demonstrate that the germs of malaria do not exist in the air. On the other hand, it is biologically impossible to conceive of their existence in the air. The burden of proof rests upon those who claim that malaria can be transmitted by breathing the air without the intervention of the mosquito. The idea that malaria is transmitted by the air or drinking water is purely a theory, without proof back of it. It should be recalled that mosquitoes fly at night. Hence it is natural for people to infer that night air causes malaria. Furthermore, mosquitoes are common near swamps; hence the idea is prevalent the air of the swamps caused the disease."

Dr. L. O. Howard, the entomologist of the Department of Agriculture, tells of certain districts where malaria has been practically stamped out by killing off the mosquitoes. He is of the opinion that boards of health and municipal authorities will be forced to take up the question of the extermination of the mosquito in a systematic manner and thus rid their neighborhoods of the cause of this disease. While aware that many physicians are still skeptical regarding the transmission of malaria by mosquitoes, he urges a sanitary campaign against the malaria mosquito, which can be recognized by those seeking to exterminate him. He can be detected in the dark as well as during the day. His note in singing is about four tones lower than the ordinary mosquito, a fact that corresponds with the usual distribution of parts in operas, where the villain always has the bass.

Dr. Howard says the best method of exterminating mosquitoes is by pouring kerosene on the stagnant water where they breed. This kills the larvæ in the water and the adult female when she comes to lay her eggs. In cases where it is impractical to use petroleum, small minnows placed in the water will rapidly devour the mosquito larvæ.

What is said to be the longest train ever hauled on the Northern Pacific was moved from Jamestown to Fargo on May 17. The train consisted of 125 box cars, five of which were loaded. It was 5,530 feet long, or over a mile. The train was hauled by one of the large compound locomotives.

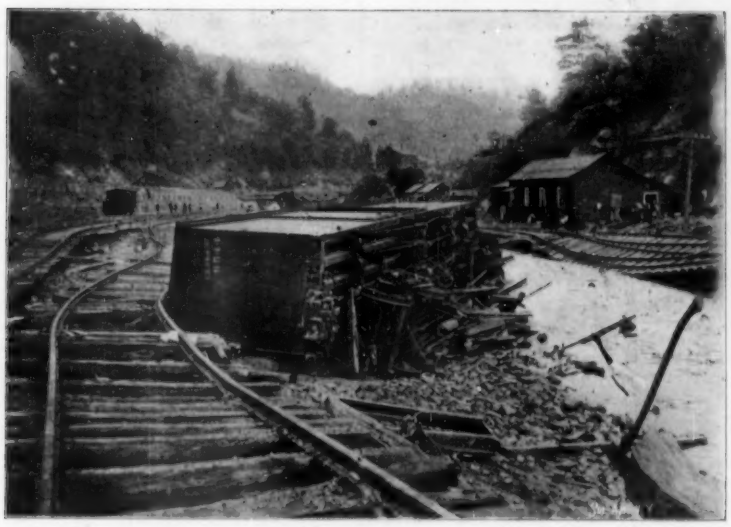
THE WEST VIRGINIA FLOOD.

The flood which overwhelmed the great Pocahontas coal field in West Virginia on June 22 and 25 resulted in great loss of life and property, especially in the Elkhorn Valley. The number of persons who were known to have perished is thirty-five, but undoubtedly many more were swept away in the flood, and their bodies may never be found. Owing to the peculiar conditions of a mining community the list of the missing is believed to be untrustworthy. At Keystone the water began rising at nine o'clock Sunday morning, and in two hours at least two-thirds of the village had been swept away. Little damage was done to the mines proper, as the drift mouths were high up on the mountainside. In the Elkhorn Valley it is estimated that the loss to the railroad and coal interests will exceed $2,500,000. About twenty bridges were swept from their foundations, and in some instances the great girders were carried more than 100 feet. Large trees were torn up by the roots and carried long distances, while wooden buildings were swept away or dashed into pieces against the bluffs. Even the coke ovens, which were built of solid masonry, were which was torn away and carried a considerable distance, notwithstanding its great weight. One of our illustrations shows how the wooden houses of the mining town were converted into tinder wood. Occasionally, if a house were very well built, it was carried intact quite a distance. Freight cars in large numbers were overturned, and in many cases entirely destroyed, even the metal work and trucks being torn away from the body.

While the flood was one of large proportions, it was not the most disastrous of its kind. The Johnstown flood, which occurred on May 31, 1889, entailed a loss of 2,000 lives and a destruction of over $9,000,000 in property. The conditions were also different, as the catastrophe was caused by the breaking of a dam after several days of heavy rain. The valley was also a narrow one, the lake being some 275 feet above the level of Johnstown, and the result was that the water flowed through the valley at an enormous rate of speed, scouring the whole width as it went. The flood traveled 18 miles in 7 minutes. Nearly $3,000,000 was raised for the relief of the sufferers. The Galveston disaster last September, which caused a loss of over 5,000 lives and enormous property damage, was an inundation rather than a flood. There appears to be no way of controlling streams in such narrow valleys, and it is doubtful if even costly dams would be very efficacious.

Truss of a Bridge Torn Away at Kyle, W. Va.

Freight Train Destroyed by the Flood.



Damage to the Railroad at Elkhorn, W. Va.

Buildings Transported and Destroyed by the Flood.

THE WORK OF THE WEST VIRGINIA FLOOD.

destroyed. The damage to railroad trains was especially great, and three of our illustrations show the work of the flood. The grading of most of the railroads was entirely washed away. At Keystone the railway embankment gave way, or otherwise very little of the village would have been left. Over thirty miles of the tracks of the Norfolk and Western Railroad were destroyed, and the telegraph wires were swept away, adding much to the horror of the situation, as no communication could be established with the outside world. A passenger train was caught by the flood at Vivian, W. Va., and the lives of the passengers were saved by the use of ropes and they were dragged over the coke ovens to a point of safety.

The peculiar conformation of the Elkhorn Valley is responsible for a large part of the damage. At times the valley is not over 1,000 feet wide at any one place, and occasionally for miles there is hardly enough level land for a roadbed, the mountains rising abruptly from the side, leaving barely space enough for the roadbed. The Norfolk and Western Railroad runs through this territory for 100 miles. One of our engravings shows a truss of the bridge at Kyle, W. Va.,

Cost of English and American Locomotives.

In the discussion of the relative cost of English and American locomotives much stress is laid upon the alleged fact that the former are better finished than the latter, but exactly where they are better finished is not stated, whether in the working surfaces or on exterior parts not under friction. American locomotives, in our experience and observation, are as well finished as there is any occasion for; that is to say, all the main connections have a good "wiping finish;" by which is meant surfaces that can be wiped clean, so as not to cause dust to adhere to them. But the eccentric rods (blades in England), reach rods, tumbling shaft, rocker arms, etc., are not finished, in the sense of being brightly polished, for the very good reason that our railways do not want them to be. If once polished they must be kept so, or else they will rust, and to prevent this they are often painted black by the master mechanics. The chief working surfaces of American locomotives are highly finished, as, for example, the guide bar faces, piston rods and valve stems, all the bearings and their brasses, and every part that carries a load. Finish is a very elastic term, and may mean much or nothing, according to how it is used. It is possible to polish surfaces very highly at comparatively slight expense by mechanical methods, but when it comes to handwork, old-fashioned ways of draw-filing surfaces, taking out all the scratches that can be seen by close examination and using emery cloth subsequently, finish may be very costly, indeed, and we suspect that this is what English critics have in mind when they assert that American locomotives are not highly finished. They are not intended to be from this aspect of the subject.

The Current Supplement.

The current SUPPLEMENT No. 1333 has a number of remarkably interesting articles. "Logging in the Redwood Forests of California" is accompanied by seven engravings. "The Report of the Secretary of Agriculture" describes all of the important work done by the various Bureaus of the Department during the year 1900. "The Development of the Chick" is by Prof. Thomas H. Montgomery, Jr. "The Treasure Found at Boscoreale near Pompeii" is accompanied by two engravings. "Cocoa and Chocolate" is a very full article accompanied by a number of highly attractive engravings. "The Fire Hazard of the More Important Chemical Products" is by Ernest H. Cook. "Congress of Aeronautics" is by the Paris correspondent of the SCIENTIFIC AMERICAN.

Contents.

(Illustrated articles are marked with an asterisk.)

RECENTLY PATENTED INVENTIONS.

Engineering Improvements.

ROTARY ENGINE.—THOMAS R. BELLAS, Joplin, Mo. The invention provides a construction in which a number of cylinders or working-chambers are located within a small space so as to secure a powerful engine of small dimensions. The construction is furthermore such that a compound action is obtained and that the periods of operation by live steam and by expansion may be varied in their relative length.

Mechanical Devices.

STONE AND DIRT LOADING MACHINE.—CHARLES C. TROXELL, Caldwell-on-the-Hudson, N. Y. Mr. Troxell has devised a light, economical machine for picking up stones or for elevating dirt and delivering the gathered material to a cart or other receptacle connected with the machine. Endless carriers are mounted to travel on the vehicle-frame. Pockets are formed on the carriers; and fingers form part of the pockets. These fingers are adapted to pick up material. At the rear of the frame guard-fingers are provided which co-act with guard-plates. An adjusting mechanism is provided for the fingers and guard-plates.

OAR-MAKING MACHINE. — WILLIAM T. JONES, New Westminster, British Columbia, Canada. The inventor has devised a very ingenious machine for making oars and similar irregularly shaped work. The machine is simple in its construction and performs its work with an efficiency that leaves nothing to be desired.

RUG-STRAIGHTENER.—GEORGE T. WEEKS, Edon, Ohio. Mr. Weeks has provided a light, extensible frame on the lazy-tongs principle for the purpose of straightening a rug and preventing the ends or corners from turning up. The frame is readily attached to or removed from the rug.

GAS AND AIR MIXER.—GUSTAV RAAF, Berlin, Germany. The object of the invention is to provide a device for producing compressed air and for conducting it to the air-suction apparatus which serves as an air-meter. A device regulates the work of this compressed air mechanism, which device is controlled by the pressure of the gas and air mixture within the service-pipe.

FAUCET.—JOSEPH NAGENGAST, Bayonne, and JOHN HÜLSS, Elizabeth, N. J. The faucet is constructed principally of wood and nickel in such a manner that the liquid (a chemical or dyeing solution) will not come in contact with a metallic surface and so that a plunger-valve will be operated by an external lever. This lever may be locked in various positions and the plunger held seated or at such distance from its seat that the flow of liquid may be regulated.

MACHINE FOR MAKING COMMUNION-WAFERS.—JOHANN J. EUGSTER, New Riegel, Ohio. This machine consists of two boxes or sections pivotally connected, the one larger than the other. The smaller box has its bottom at a higher level than the larger box. A die plate is located at the top of the smaller box; and a heating-plate is adapted to be brought on top of the die-plate. The machine is operated very readily and is provided with effective devices for keeping the operating parts clean.

WASHING-MACHINE.—EDWARD CAMPBELL, Winnipeg, Manitoba, Canada. A series of partitions are so arranged as to form compartments for the reception of clothes, one compartment being independent of another so that fine material may not be brought in contact with heavier goods. Water is delivered to the various compartments. A rubber in each compartment has a rotary or a rotary-reciprocating movement whereby the clothes in the various compartments are rubbed clean.

FIRE-EXTINGUISHER. — GEORGE W. THOMPSON, Cole Building, Nashville, Tenn. The device is of that character in which the sprinkler-head is located in a water-supply pipe in a convenient position. The valve is held closed by a fastening, the separate sections of which are bound together by a fusible substance. This invention is an automatic fire-sprinkler of this character which will hold the valve securely to its seat at normal temperature without being disturbed by variations in the pressure of the water in the service-pipe, and which is yet very sensitive to abnormally high or dangerous temperature.

AUTOMATIC FIRE-EXTINGUISHER. — GEORGE W. THOMPSON, Cole Building, Nashville, Tenn. This invention is an improvement in stationary fire-extinguishers and alarms in which air and water pipes are distributed throughout a building and provided with sprinklers to be manually or automatically operated. The invention relates more particularly to the automatic valve mechanism which controls admission of water to the pipes, the latter being normally filled with air under a predetermined pressure. This pressure being lowered by opening one or more sprinklers, the mechanism opens the water-supply valve and allows water to flow into and fill the air-pipes and discharge from the sprinklers.

Vehicles and Their Appliances.

AIR-PUMP FOR PNEUMATIC TIRES.—GEORGE B. STACY, Boston, Mass. The object of the invention is to provide a pump which is arranged to avoid leakage and to force a sufficient quantity of air into the tire to keep the tire inflated in case of a puncture or other leakage. The pump is attached to the tire and is so arranged that when the tire is deflated the pump-plunger will come into contact with the interior of the tire and will be actuated to force air into the tire as the wheel is turned.

AUTOMATIC TANK-PUMP FOR AUTOMOBILES.—GEORGE B. STACY, Boston, Mass. Mr. Stacy has in this patent described a pump actuated while the automobile is in motion by one of the wheels, the pump being designed to fill the air-tank to insure the proper working of the motor employed for propelling the vehicle. The pump is operated by a cam on the hub of the wheel.

AUTOMATIC TIRE-INFLATER.—GEORGE B. STACY, Boston, Mass. In this invention the main object has been to provide a tire-inflater locked by the tire against movement while the tire is being inflated, and arranged to be automatically actuated upon deflation of the tire by the device's coming in contact with the ground at every revolution of the wheel.

VEHICLE-BRAKE.—JOSEPH N. CALLAHAN and JEFFERSON D. SHORT, Henrietta, N. C. The invention relates to a type of vehicle-brake which effects a positive lock between a vehicle axle and the wheels. On the rear axle is a guide-block in which two locking-bars are held to slide. Springs press the locking-bars out. By means of a lazy-tongs the locking-bars are retracted and the springs compressed. The lazy-tongs device is operated from the front of the vehicle. The locking-bars are held back against the stress of the springs, but are releasable from the front of the vehicle.

Miscellaneous Inventions.

LIFE-BOAT.—BENVENUTO GIANESE, Genoa, Italy. The inventor has devised an apparatus to be used on board ships in place of the usual life-boats. The principal feature of the apparatus lies in the fact that it can be readily and automatically thrown overboard in any case of emergency without danger of its being submerged.

LANCET. — ROBERT CALDWELL, Auckland, New Zealand. The instrument is designed to cut through the obstruction that sometimes forms inside of the lower end of the cow's teat, so that the milk may thereby be made to flow more freely.

FRUIT-JAR HOLDER. — SIMEON L. BRAY, Evansville, Ind. The jar-holder comprises a base on which a post is mounted. A clamping-lever has swinging connection with the post and is provided with an opening to receive the neck of a jar. The device will tightly hold a jar during the sealing thereof, and will obviate the touching of the hot jar with the hands.

TOY.—CHARLES W. WALTERS, Richmond, Va. The improved toy is an amusing novelty designed to represent a child bathing. The child suddenly emerges from the water when the cover of the tank is quickly raised.

BASIC FIREBRICK COMPOUND.—SPENCER B. NEWBERRY, Sandusky, Ohio. The refractory compound forming the subject of this invention has for its principal ingredients tricalcium silicate and free magnesia, but contains no free lime. The compound is basic and permanent and non-slaking on exposure to air.

BOX-LID OPENER OR CLOSER.—NORMAN P. HICKS, Brooklyn, New York city. The invention relates to improvements in devices for opening the lids of inking-pad boxes and comprises a lever fulcrumed on the side of the box and provided with an inwardly-extending lug which projects through a notch in the lid and with an upwardly-turned arm to receive the lid in open position. Upon depressing the end of the lever, the lug raises the lid and forces it back against the arm.

CLOSET-SEAT. — MARTINA T. ROBINSON, Bloomsburg, Penn. The seat is adapted for the use of children, and is so constructed that it can be compactly folded. Hence it may be conveniently carried when traveling. The seat can be securely fastened to an ordinary closet-seat without injury thereto.

ADJUSTABLE SHELF AND SUPPORT THEREFOR.—DEAN A. BECKWITH, Manhattan, New York city. The shelf is arranged to permit the placing of a desired number of shelves in a cabinet and to permit the shelves to be readily adjusted to form spaces of the desired height, according to the room needed for books, merchandise, or other articles.

BEACH-PROTECTOR. — CHARLES H. VAN ORDEN, Catskill, N. Y., and EDWARD B. COOMBS, Manhattan, New York city. The object of the invention is to protect beaches by the use of mattresses so that the surf is prevented from washing away the sand from the beach and destroying valuable property. At the same time the mattresses form a barrier to break the force of the surf and a means for the deposition of the sand carried by the water for reclaiming the land.

PROCESS OF STORING AND AVERAGING ORE IN BULK.—EDWIN H. MESSITER, Apartado Postal 132, San Luis Potosi, Mexico. The usual procedure of lead-smelting is to "bed" the ores by forming each kind of ore into a horizontal layer in a rectangular bin. The ores are removed from the beds by entering through doors in the sides of the bins and attempting to cut the beds down vertically. The caving of the ores causes irregularity in the resulting mixture. The leading feature of this process consists in bringing in the ore by means of an elevated conveyer which discharges the material, not from a fixed and definite point, but from a traveling point, uniformly along a certain portion of its length by a kind of sowing action caused by the travel of the discharge devices.

SPRING ATTACHMENT FOR FISH-HOOKS.—ALBERT D. GARY, Lavonia, Ga. The invention is an improvement in the class of spring attachments for fish-hooks which are adapted to be set by pressing a spring and to be released by a pull on the hook, whereby a fish seizing the bait is impaled and caught. The invention is distinguished by simplicity, cheapness and portability. The device is composed of two members, one of which is connected with a hook and the other with the fishing-line.

FORMATION OF COLORED FABRICS.—PAUL B. WORTHINGTON, Manhattan, New York city. The colors are to be applied to the fabric by the use of brushes and by the aid of stencil-plates. The fabrics are to be subsequently embroidered to form pillow-tops and the like. Part of the fabric is given a firm support or backing, and the remainder is left unsupported or unbacked. A part of the fabric is covered so as to leave only a section exposed. To this exposed portion color is applied to cause the absorption of more color on the back portions of the exposed sections than on the unbacked portion.

Designs.

THILL-COUPLING PLATE. — JAMES L. KEHL and JOHN GARTHE, Northport, Mich. The thill-coupling plate is so formed that the coupling may be held so that it cannot fall out of its own accord.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

NEW BOOKS, ETC.

STEAM BOILER ECONOMY. By William Kent, A.M., M.E. New York: John Wiley & Sons. 1901. 8vo. Pp. 472, 126 illustrations. Price $4.

A treatise on the theory and practice of fuel economy in the operation of steam boilers. This is one of the most important subjects which interest mechanical engineers to-day. The author has been conducting tests since 1875, so that he is thoroughly familiar with his subject. It is an eminently practical and useful book.

A MANUAL OF PRACTICAL HYGIENE FOR PHYSICIANS AND MEDICAL OFFICERS. By Charles Harrington, M.D. Philadelphia and New York. 1901. 8vo. Pp. 729. Price $4.25.

A most comprehensive book, dealing with the subject in a masterly way. It is the best book on hygiene we have seen in many years. We have not the space to give even the chapter headings, but it is safe to say it contains everything within the purview of the subject.

TWELFTH BIENNIAL REPORT OF THE STATE BOARD OF AGRICULTURE OF KANSAS. Vol. XVII. 1899-1900. F. D. Coburn, Secretary. 8vo. Pp. 957.

Kansas is enjoying well-merited prosperity, and this report gives most valuable particulars as to the agriculture of that State. It is a model book which many State boards might well copy.

THE CEMENT INDUSTRY. Descriptions of Portland and Natural Cement Plants in the United States and Europe With Notes of the Materials and Processes in Portland Cement Manufacture. New York: The Engineering Record. 1900. 8vo. Pp. 235. Price $3.

Several years ago The Engineering Record began the publication of a series of articles upon the European and Portland cement industry. The articles were prepared for that journal by Frederick H. Lewis, M.A.S.C.E., who undertook in the interest of this inquiry a personal inspection of the important European plants, and who, on account of his familiarity with the subject, was well qualified to compare foreign with American plants. These articles form the basis of the present volume, but other plants are described by other writers. The book is most excellent, and deals with the subject in a most thorough manner.

CABBAGE, CAULIFLOWER AND ALLIED VEGETABLES, FROM SEED TO HARVEST. By C. L. Allen. New York: Orange Judd Company. 1901. 12mo. Pp. 100. Price 50 cents.

The author of this book has devoted a lifetime to this study; and, living in the very heart of the most favorable cabbage-growing section of the United States, and being himself largely and practically interested in this industry, is probably more familiar with its various details than any other man. There is a convincing and practical tone about the entire work which at once assures the reader of the safety of following the instructions given in its pages.

CHEMICAL LECTURE EXPERIMENTS. By Francis Gano Benedict, Ph.D. New York: The Macmillan Company. 1901. 12mo. Pp. 436. Price, $2.

The experiments are numerous and are well described, although the illustrations are merely diagrams. The object of the book is primarily to furnish teachers with a large number of reliable lecture experiments. The author does away, as far as possible, with elaborate and costly apparatus. This has resulted in the omission of some familiar experiments, but it has been possible in many cases to substitute an equivalent experiment.

CENTRAL ELECTRICAL STATIONS. Their Design, Organization and Management. By C. H. Wordingham, A.K.C. London: Charles Griffin & Co., Ltd. Philadelphia: J. B. Lippincott Company. 8vo. Pp. 496. Price, $7.50.

The literature dealing with central station practice is, at the present time, exceedingly limited, but that relating to many of its branches is very complete. The author recognizes the fact that there is no special need of additional books on the boiler, engine and dynamo, so he has concentrated his attention on the problems which arise in the practical operation of central stations, whether of a scientific engineering or a commercial nature, and to indicate the solution which his own experience and that of other engineers, similarly placed, has dictated. In this age of voluminous and indiscriminate publication it is refreshing to see the odds and ends of an important subject like the supply of electricity for light and power gathered together and tied in such an orderly fashion. Special attention is given to the general features of the station, mains, storage batteries, street lighting, costs, and methods of conducting the financial side of the station.

CENTRAL STATION EXPERIENCES FROM POWER. New York: The Power Publishing Company. 1901. 12mo. Pp. 106.

A humorous series of narratives on the trials and tribulations of a steam engineer while learning to run an electric station.

BAMBOO WORK. Edited by Paul N. Hasluck. London and New York. 1901. 18mo. Pp. 160. Price, 40 cents.

Bamboo work opens a new field to the amateur. With the instructions given in this eminently practical little book, it will be possible to make satisfactory bamboo articles. It is profusely illustrated.

ELECTRIC SPARKS. By Prof. James A. Beaton, A.M. Chicago: Laird & Lee. 1901. Vest-pocket form. Pp. 272. Price, leather gilt, 75 cents; cloth, 50 cents.

Considerable information on electricity is conveyed by this little book. The diagrams are excellent, and the work will prove useful to many readers who desire some acquaintance with the subject.

EXPERIMENTS ARRANGED FOR STUDENTS IN GENERAL CHEMISTRY. By Profs. Edgar F. Smith and Harry F. Keller. Philadelphia: P. Blakiston's Son & Co. 1900. 16mo. Pp. 88. Price, 60 cents.

A practical course which has been tested makes an excellent textbook. The authors have produced one of the best works on the subject we remember to have seen. It is interleaved.

A PRACTICAL TEXTBOOK OF PLANT PHYSIOLOGY. By D. T. Macdougal, Ph.D. New York: Longmans, Green & Co. 1901. 8vo. Pp. 352. Price, $3.

The author is Director of Laboratories at the New York Botanical Garden. He has produced a book which will be of great value to all students of botany. The experiments are numerous, interesting, and well explained. It is a thoroughly satisfactory scientific book. There are 159 illustrations.

NATURE BIOGRAPHIES. The Lives of Some Every-day Butterflies; Moths; Grasshoppers and Flies. By Clarence Moores Weed. New York: Doubleday, Page & Co. 1901. 8vo. Pp. 164. Price, $1.50 net.

This volume, by a well-known professor of entomology, is a sort of personal acquaintance with the lives of the more common butterflies, grasshoppers, moths, etc. Many photographic illustrations help to give reality and charm to the author's descriptions. It is a handsome example of the bookmaker's art.

TUNNELING. A Practical Treatise. By Charles Prelini, C.E. With additions by Charles S. Hill, C.E. New York: D. Van Nostrand Company. 1901. 8vo. Pp. 311. Price, $3.

Strange as it may appear, there are but two books on tunneling in the English language; the present makes the third. The older books were not adapted for textbooks, so the author has done a real service to engineering literature by preparing a work which will be of special value to students. The question of tunneling-shields is admirably treated, although the late Alfred Ely Beach, of the SCIENTIFIC AMERICAN, does not seem to have received adequate credit for his system of using hydraulic jacks, which was superior to the Greathead system.

SAW FILING AND MANAGEMENT OF SAWS. By Robert Grimshaw, M.E. New York: Norman W. Henley & Co. 1901. 16mo. Pp. 93. Price, $1.

A thoroughly practical treatise on filing, gumming, swaging, hammering and brazing of patent saws: the speed, work and power to run circular saws, etc. The book has been well received in former editions, and it has now been thoroughly revised and brought up to date.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**
MUNN & CO.

Marine Iron Works. Chicago. Catalogue free.

Inquiry No. 1013.—For the manufacturers of the "Kitchen Ice Machine."

TURBINES.—Leffel & Co. Springfield, Ohio, U. S. A.

Inquiry No. 1014.—For manufacturers of tools for repairing pianos, harmoniums and other musical instruments.

"U. S." Metal Polish. Indianapolis. Samples free.

Inquiry No. 1015.—For a spring motor machine which can be operated by one man.

WATER WHEELS. Alcott & Co., Mt. Holly, N. J.

Inquiry No. 1016.—For deflated toy rubber gas balloons.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Inquiry No. 1017.—For the manufacturer of the "Pennsylvania" high-wheel lawn mower.

Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 1018.—For manufacturers of chemical fire engines.

Sheet Metal Stamping: difficult forms a specialty. The Crosby Company, Buffalo, N. Y.

Inquiry No. 1019.—For manufacturers of specialties in pipe stems or mouthpieces.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 1020.—For manufacturers of wind powers for use on a farm for shelling corn, grinding feed, etc.

For Sheet Brass Stamping and small Castings, write Badger Brass Mfg. Co., Kenosha, Wis.

Inquiry No. 1021.—For manufacturers of electrical house goods, such as burglar alarms, bells, short line telephones, etc.

Rigs that Run. Hydrocarbon system. Write St. Louis Motor Carriage Co., St. Louis, Mo.

Inquiry No. 1022.—For manufacturers of acetylene gas generators.

Ten days' trial given on Daus' Tip Top Duplicator. Felix Daus Duplicator Co., 5 Hanover St., N. Y. city.

Inquiry No. 1023.—For manufacturers of wire netting machinery.

SAWMILLS.—With variable friction feed. Send for Catalogue B. Geo. S. Comstock, Mechanicsburg, Pa.

Inquiry No. 1024.—For manufacturers of gas engines in New York City.

We are equipped to manufacture all kinds of specialties. Send samples. Chicago Handle Bar Co. Chicago Ill.

Inquiry No. 1025.—For manufacturers of machines for making wooden pegs for shoes.

Kester Electric Mf'g Co's, Self-fluxing solder saves labor, strong non-corrosive joints, without acid, Chicago, Ill.

Inquiry No. 1026.—For manufacturers of pressed paper goods, such as pie plates, etc.

Manufacturers of Valves, Fittings, Brass and Iron Work. Spindler & Deringer, 18-22 Morris St., Jersey City, N. J.

Inquiry No. 1027.—For a gun to shoot a Winchester 44 shell, 1873 model, with one barrel, the other to be 14 gage shot.

Special and Automatic Machines built to drawings on contract. The Garvin Machine Co., 149 Varick, cor. Spring Streets., N. Y.

Inquiry No. 1028.—For manufacturers of ice machines.

WANTED.—Party with means to make and test an apparatus in which liquid air can be made. Address H. A. Lassetor, Leander, Texas.

Inquiry No. 1029.—For manufacturers of electric dynamos.

See our Collective Exhibit—Section "S," Electricity Building, Pan American Exposition. Standard Welding Company, Cleveland, Ohio.

Inquiry No. 1030.—For manufacturers of rag carpet fly shuttles with large wheels and pickers for the same.

FOR SALE.—New process for making oil with fish and fish offal is offered for sale or licenses in United States of America. Address Foreign, Box 773, New York.

Inquiry No. 1031.—For address of parties having Swedish anvils for sale.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 1032.—For dealers in second-hand turning lathes and drill presses in Chicago, if possible.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

Inquiry No. 1033.—For manufacturers of air pumps and compressors.

WANTED.—A thoroughly competent engineer to push in United States of America a new, efficient and economical process, for dealing with large benefit towns' sewage and refuse waters from industry. Address France, Box 773, New York.

Inquiry No. 1034.—For dealers in elevating machinery for elevating grain and feed, and machinery for cleaning oats.

Wanted.—Foreman Repair Department by textile manufacturers, having a first-class plant. Must be a thorough mechanic, good engineer, able to make electrical repairs, etc. Wages, $4 per day and no time lost. Address giving age, experience and full particulars, to C. & Co., P. O. Box 1816, New York City.

Inquiry No. 1035.—For manufacturers of electrical heating apparatus.

For sheet metal stamping, metal spinning, nickel plating, punch and die work, press work, and manufacture of all kinds of specialties write The Admiral Lamp Company, Marysville, Ohio.

Inquiry No. 1036.—For manufacturers of portable houses.

MCGILL UNIVERSITY, MONTREAL.—*Chair of Metallurgy.*—The Governors of McGill University, invite applications for the Professorship of Metallurgy. Candidates for the appointment are requested to send their testimonials, with a statement of age, qualifications, etc., to the Secretary of the University, before September 1. The duties of the post will commence on October 1. Full particulars of the work, salary, etc., may be obtained from the Secretary.

Inquiry No. 1037.—For manufacturers of models of locomotives, made of cardboard.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Inquiry No. 1038.—For manufacturers of a contrivance for burning petroleum in ordinary heating and cooking stoves.

Inquiry No. 1039.—For manufacturers of coffee roasters of about 150 pounds capacity and a cooler for same.

Inquiry No. 1040.—For manufacturers of small rubber balloons made of thin, white rubber.

Inquiry No. 1041.—For parties to make a metallic device for holding rubbers on when walking in mud.

Inquiry No. 1042.—For parties to manufacture a metallic device for checking and unchecking horses attached to vehicles without leaving the seat.

Inquiry No. 1043.—For parties to make a combined bicycle pump and seat post.

Inquiry No. 1044.—For the present address of the Farmers' Handy Wagon Co.

Inquiry No. 1045.—For manufacturers of aluminium springs 8 inches long, ⅝ inches wide and 1-32 or 1-8 inch thick.

Inquiry No. 1046.—For the manufacturers of a mechanical apparatus used for loading coal inside the pits, in the United States.

Inquiry No. 1047.—For manufacturers of machines for making tarred paper felts for roofing.

Inquiry No. 1048.—For builders of special machinery for weaving wire fences, etc.

Inquiry No. 1049.—For manufacturers of hot air engines with exhausts.

Inquiry No. 1050.—For manufacturers of cork-grinding machinery.

Inquiry No. 1051.—For manufacturers of stone-crushing machinery.

Inquiry No. 1052.—For manufacturers of small tin boxes with screw lid suitable for mailing samples of sand, three-quarters of an inch in depth and two inches in diameter.

Inquiry No. 1053.—For a machine to rivet 3-16 inch to 1-4 inch soft steel rivets 1 1-2 inch long, to secure 14 gauge plates to wood.

Inquiry No. 1054.—For manufacturers of strong metal cement.

Inquiry No. 1055.—Wanted, British agency for duplicating machines, office devices of all kinds, also hardware specialties.

Inquiry No. 1056.—For manufacturers of typewriter supplies.

Inquiry No. 1057.—For manufacturers of photographic goods.

Inquiry No. 1058.—For manufacturers of automobiles.

Inquiry No. 1059.—For manufacturers of bicycles and sundries.

Inquiry No. 1060.—For manufacturers of gramophones and gramophone dictation supplies.

Inquiry No. 1061.—For manufacturers of electrical novelties.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(8269) W. B. H. writes: I was given a question in a recent examination that the examiner stated was proved in a copy of your magazine; but he could not state the date the example appeared nor prove it himself. The problem read: "Do the amperes or volts increase when the electricity passes through an ordinary spark coil for gas lighting?" I said volts, yet my examiner says the answer is amperes, which I doubt. A. The volts are raised in the action of the ordinary spark coil in gas lighting. This coil has but one winding, no secondary. It is not an induction coil in the usual sense. The spark is produced by the self-induction of the current in the turns of the primary upon itself. This produces a higher E. M. F., which causes a considerable spark. There can be no more amperes in the circuit than the generator can produce.

(8270) F. B. asks: Please answer the following through your columns. I have a vessel containing 16 parts of pure whisky. If I take one part out and fill it with water, so the vessel is still full, and so continue until I have taken 16 parts out of it, how much whisky is there in the sixteenth or last part? How can this be calculated? A. You must excuse us from answering this very interesting question. Life is too short. We will, however, give you the method of finding the answer and you can employ your leisure time upon it. When the vessel is filled with water the first time the mixture is 15-16 whisky. One-sixteenth of this is drawn out and replaced with water. The mixture thus becomes 15-16 as strong as it was the time before, or 15-16 x 15-16 whisky. This is $(15\text{-}16)^2$, or 225-256 of the whole. The next time there will be $(15\text{-}16)^3$ whisky left; and so on to the sixteenth filling, when there will be $(15\text{-}16)^{16}$ of whisky, and the rest will be water. The last state of this is strong enough for health. Multiply the fraction 15-16 by itself fifteen times, and you will have the answer. Buy a lot of large-sized sheets of paper before you begin.

(8271) W. A. L. asks: Is there any other metal that can be used in a gravity battery besides zinc that will not dissolve? A. There is no way of obtaining electricity without using up some material. In the dynamo steam or water power is employed. In the battery we usually burn up zinc. It is just as impossible to produce electricity without a disappearance of some other form of energy as it is to heat a house and still have the coal, or cool a refrigerator and still have the ice.

(8272) J. K. asks: Please inform me why two telegraphic instruments will not work when set up in series. One of the instruments is a 4-ohm, and the other I think is larger. The larger one can be heard from another room, while the small one can barely be heard at all. A. The smaller of the two instruments does not get current enough to work the magnet. In order to work together, they should have nearly the same resistance.

(8273) E. B. asks: 1. Have you any SUPPLEMENTS containing articles relating to the care and maintenance of the sal ammoniac battery used in telephone work? A. Carhart's "Primary Batteries" gives considerable space to the sal ammoniac battery. Price $1.50 by mail. 2. Can you recommend a book suitable for one who has to look after the repair of a telephone line? A. Hopkins' "Telephone Lines and Their Properties," price $1.50 by mail.

(8274) J. S. T. writes: I have been fitted with glasses to correct astigmatism. Without glasses the rays of an ordinary street lamp appear extended perpendicularly; with the glasses they appear longer the opposite way. If glasses were properly ground, should not the rays radiating from light appear of uniform length? A. If your astigmatism were perfectly corrected by the glasses, objects would be seen in their correct outlines.

(8275) W. M. S. asks: 1. Whether a patent has ever been taken out in this country or abroad for a wireless telephone? If so, will you explain briefly the principle of its operation? A. The waves set up by the transmitter of a telephone can be transmitted into the space around the line and to a certain distance from the wire in the same way as is done in wireless telegraphy. No one knows to what extent this may be developed in the future. 2. Whether a patent has ever been granted for an optical transmitter of pictures by electricity? By that I mean an instrument which will transmit a scene before a camera-like sender and reproduce it on a screen, or otherwise impress the transmitted picture on the eye, either with or without their natural colors. If so, will you explain the bare principle? A. We do not know of any such process in a practical form, though it has often been the subject of speculation and somewhat of experiment. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 1178. 3. Is there any solid, reasonably good conductor of electricity which can be applied with a brush when liquid? A. Almost any bronze or aluminium powder may be applied by a brush so as to be a conductor.

(8276) W. A. P. asks: 1. Should an ampere-meter be placed in the positive or negative terminal of a direct-current 110-volt dynamo? A. The ammeter may be placed at any point whatever in an electric circuit, since the same current flows through every part of a circuit. This is just like the flow of water through a pipe. If you had a pipe 1,000 feet long from a reservoir to your house, the same water and just as much would flow through every foot of the pipe, and a meter might be put into the pipe at any point in its length and the quantity of water flowing through the meter to be measured. 2. How much more would it register in the former than in the latter? A. It would register the same in either side of the circuit. It makes no difference where the ammeter is placed.

(8277) B. A. T. asks: 1. How many pounds of wire are used to wind the armature of the electric motor described in the issues of the SCIENTIFIC AMERICAN for December 8 and 15, 1900? Also the field magnet? A. About a half-pound for the armature and the same for the field. 2. How many watts are necessary to run it at its utmost power? A. We do not know. Somewhere from 12 to 24. Four cells of 2-volt battery, put two on series, should run it. 3. Cannot other journal boxes than the brass balls mentioned be used, such as a block of iron smoothly bored? A. Yes, of course; any kind of bearings can be used.

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